JOURNAL
OF THE
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OF
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OF
GREAT BRITAIN AND IRELAND.

THE FEDERATION OF INSURANCE INSTITUTES OF GREAT BRITAIN AND IRELAND.

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1905

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Dr.		
To Balance from last Account		£192 17 3
,, Journal Sales—		
Institutes	£167 18 4	
C. & E. Layton	31 11 5	
Sundry Sales	28 1 10	
		227 11 7
,, Examinations—		
Entrance Fees		68 6 6
,, Contributions—		
Insurance Companies	£91 19 0	
Institute Levies	48 15 6	
		140 14 6
Bank Interest		4 13 2
		£634 3 0

Cr.		
By Journals—		
Printing Volume VI.		£265 10 8
,, Examinations—		
Printing and Stationery	£36 12 6	
Postages	2 14 5	
Clerical Assistance	13 0 0	
		52 6 11
,, Prizes for Essays		20 0 0
,, General Expenses—		
Secretary's Salary	50 0 0	
Allowance for Office Expenses	15 0 0	
Postages and Petty Cash	14 14 10	
Printing and Stationery	3 16 6	
		83 11 4
,, Balance—		
Cash in Bank	209 6 3	
Cash in Hand	3 7 10	
		212 14 1
		£634 3 0

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Objects: (1st) The reading of papers and delivering of lectures by members, or experts who are not members, upon subjects connected with Insurance business generally. (2nd) The discussion of all questions relating to such business. (3rd) The promotion of social intercourse amongst members of the profession in Birmingham and district.

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Objects: The cultivation of knowledge of Insurance business generally (excluding Actuarial, Mathematical, and other cognate subjects, these being already provided for by the Faculty of Actuaries); the formation of a Library of professional works for the use of Members and Associates; and the promotion of social intercourse among those connected with the Insurance profession.

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Note.—5s. annually qualifies for Membership. £3 3s. in one sum qualifies for a Life Membership.

President—The Right Honourable Lord Rothschild, G.C.V.O.
Vice-Presidents—The Right Hon. Lord Avebury, F.R.S., D.C.L., LL.D., Director, *Phœnix Fire, Pelican and British Empire Life,* and *British and Foreign Marine;* S. A. Beaumont, Managing Director, *County Fire* and *Provident Life;* George H. Burnett, Hampstead; John Coles, Chairman, *Clerical, Medical and General Life;* Sir F. D. Dixon-Hartland, Bart., M.P., Director, *The Westminster Fire* and *Westminster and General Life;* C. G. Fothergill, Director, *London and Lancashire Fire;* H. Ernst Hall, Chairman, *Fire Offices' Committee;* Robert Lewis, *Alliance,* Marlborough R. Pryor, Director, *Sun Fire.*
Chairman—Saml. J. Pipkin, *Atlas.*
Deputy-Chairman—E. H. Holt, *Law Life.*
Office—11 Queen Street, Cheapside, London.
Secretary—R. C. Cole.

THE FEDERATION OF INSURANCE INSTITUTES
OF GREAT BRITAIN AND IRELAND.

THE Ninth Annual Conference was held in the Midland Hotel, Manchester, on Friday, 2nd June, 1905, on the invitation of The Insurance Institute and the Insurance Association of Manchester. Mr. Thomas A. Bentley (London and Lancashire Fire Insurance Company), President of the Federation, occupied the chair, and there were present:—

Past Presidents—JAMES OSTLER (Northern); and JOHN G. BOSS (Royal).

Hon. Secretary to the Examiners—A. W. SNEATH (Hand-in-Hand), Leeds.

Hon. Secretary to the Publications Sub-Committee—ARCHIBALD BLAIR (late London & Lancashire Fire), Glasgow.

Hon. Secretary to the Insurance Institute, Manchester—H. M. BENTLEY (Western), Manchester.

Examiners—CHARLES D. BUTLER (Royal Exchange), Birmingham; J. H. CHAPMAN (Norwich Union), Newcastle-on-Tyne; A. S. FRASER (Commercial Union), Dundee; JAMES HASLAM (Ocean Accident), Nottingham; WILLIAM HOLBROOK (Royal), Leeds; JOHN ROBERTSON (Northern), London; A. GIBBON THOMPSON (Life and Health), Edinburgh.

Insurance Clerks' Orphanage—SAMUEL J. PIPKIN (Atlas), London, Chairman; ALBERT D. BROOKES (Alliance), Bristol, Founder.

Secretary to the Federation—CHARLES STEVENSON, Manchester; and the following delegates:—

BIRMINGHAM - - - A. E. PATRICK (*Westminster*), President.
A. J. LEWIS (*Sun*).
C. F. CARSON (*Patriotic*), Hon. Secretary.

BRISTOL - - -	W. BLAIR (*Northern*), President. A. F. TOOKE (*Westminster*), Vice-President. GRAHAME H. WILLS, Past President.
EDINBURGH - - -	DAVID PAULIN, F.F.A., F.R.S.E. (*Scottish Life*), President. A. D. LINDSAY TURNBULL, F.F.A., C.A. (*Scottish Widows'*). D. M. CAMERON (*Alliance*), Hon. Secretary.
GLASGOW - - - -	N. B. GUNN, F.F.A., F.I.A. (*Scottish Amicable*). STEWART LAWRIE (*Alliance*), Hon. Secretary.
IRELAND - - - -	R. Y. MURRAY WRIGHT (*Royal*), President. W. S. KINNEAR, B.A. (*Royal Exchange*). W. A. MCCONNELL (*Caledonian*), Hon. Secretary.
MANCHESTER INSTITUTE -	G. L. LAMBERT (*North British and Mercantile*), President. J. LOUDON (*Royal Exchange*).
MANCHESTER ASSOCIATION -	A. MACNIVEN (*Sun Life*), President. W. H. HOYLE (*Westminster*). J. K. M'MYND (*London Guarantee*).
NEWCASTLE-ON-TYNE -	J. S. WATERSTONE (*Royal Exchange*), President. J. G. OGILVIE (*Caledonian*), Vice-President. F. F. WORTHINGTON (*Union*) Hon. Secretary.
NORWICH - - -	H. D. CURNICK (*Norwich Union*).
NOTTINGHAM - - -	J. W. FOSTER (*Scottish Amicable*), President. L. J. TOWLE (*Atlas*), Vice-President. D. M'MICHAEL (*Commercial Union*).
YORKSHIRE - - -	F. J. ALLEN (*Atlas*), Leeds. E. BAGSHAW (*Phœnix*), Leeds, Hon. Secretary.

Apologies were received from:—

Past Presidents—S. G. Moxey (*Prudential*), Bristol; D. L. Laidlaw (*North British and Mercantile*), Glasgow.

Hon. Secretary to the Examiners—J. P. Eddison (*North British and Mercantile*), Leeds.

Examiners—J. H. Boocock (*Commercial Union*), Birmingham; Wm. Hartley (*London and Lancashire*), Manchester; R. McConnell (*Royal*), Manchester; James Gemmell (*Royal Exchange*), Glasgow; F. S. Goggs (*Scottish Metropolitan*), Edinburgh; P. L. Newman (*Yorkshire*), York; H. J. Pearce (*Scottish Amicable*), Glasgow; H. Pocklington (*Commercial Union*), Leeds; W. Richardson (*Norwich Union Fire*), Edinburgh; C. E. Howell, LL.D. (*Standard*), Dublin; W. E. Neish (*Northern*), Newcastle-on-Tyne.

After the adoption of the Minutes of last Conference, the Secretary read the Report of Executive Committee, 1905.

Secretary's Report, 1905.

The past year has been an uneventful one as regards the work of the Federation. No new departures have been made, but the various branches of the work are gradually extending, and the influence of the Federation generally is increasing.

The seventh volume of the Journal was not issued till March last, the unavoidable delay having been caused by changes in the Publications Committee occasioned by the retirement of Mr. Henry G. Andrewes, who has done such good service in his able conduct of the Journal for seven years. Grateful thanks are due to Mr. John Robertson of the "Northern," who kindly undertook to see the volume through the press, and, on his removal to London, to Mr. Arch. Blair, who was appointed Secretary, *pro tem*, and who has kindly thrown himself into the work. His election as Hon. Secretary to the Publications Committee will be brought before the Conference. The papers in this year's volume are of the usual varied character, about 12 out of 21 dealing with fire subjects, 4 with life, the remainder being general and financial. There are no papers dealing with Accident Insurance or Workmen's Compensation. It is interesting to note that all the affiliated Colonial Institutes have contributions in the present volume, the Institutes of Cape Town and New Zealand contributing for the first time.

The Examinations were held from 10th to 20th April,

and the number of entries and of candidates again show an increase over former years. They were held at the ten Institute centres, and also at Belfast, Dundee, Hull, Liverpool, London, Perth, Sheffield, Shrewsbury, and York. For their kindness in placing rooms at the disposal of candidates and for their attendance at the examinations as presiding officers, the thanks of the Federation are due to the officials in Liverpool of the "State," London of the "Hand-in-Hand," York of the "Yorkshire," Belfast of the "Caledonian," Dundee of the "Commercial Union," "Scottish Union," and "National," Hull of the "Ocean," Perth of the "General Accident," Sheffield of the "Alliance," and Shrewsbury of the "Alliance." Mr. J. P. Eddison, one of the joint hon. secretaries, finds it necessary to resign his important and onerous office, which he has held for so many years with acceptance and advantage to the work. He will be greatly missed in the future, and the sincere regrets at his inevitable retirement are mingled with a hearty appreciation of his past services in the cause of education.

The Treasurer's statement for the year shows that the total receipts were £441 5s. 9d., and the expenditure £421 8s. 11d., showing a small balance of receipts over expenses of £19 16s. 10d. The Executive take this opportunity of thanking the contributing offices and subscribers for their valuable financial assistance.

The Third Annual Report of the Insurance Clerks' Orphanage will be submitted to the Conference. It shows gratifying progress. The membership has increased 435 during the year, and now numbers 2527. The total invested funds are £8236 11s. 5d.

It is with sincere regret that we have to record the death of our highly esteemed past president, Mr. David Deuchar, whose devotion to the interests of the Federation during his year of office, together with his genial and kindly influence, will long live in the memory of those with whom he came in contact.

The Executive desire to record their thanks to all who have contributed to the prosperity of the Federation during

the past year; to the President, for his genial and courteous guidance of the affairs of the Federation; to the Examiners and their two honorary secretaries for the enormous labours in their department, so generously and ungrudgingly given; to the Publication Sub-Committee for their valuable work in editing the Journal and seeing it through the press; and to the Honorary Treasurer for his close attention to the finances of the Federation.

On the motion of the President the following resolution referring to the death of Mr. David Deuchar, past president, was passed in silence:—"The Conference desires to place on record its feeling of sincere regret at the loss it has sustained by the death, on 6th November last, of its respected past President, Mr. David Deuchar, F.F.A., F.I.A., F.R.S.E. His genial activities in the interests of the Federation won for him the esteem of all with whom he came in contact, while his wise counsel and great influence have done much to advance the interests of the Federation during the year of his office."

The PRESIDENT (Mr. Thomas A. Bentley) then addressed the Conference as follows:—Gentlemen,—The Councils of the Manchester Institute and the Manchester Association desire me to offer you a hearty welcome on this second visit of the Federation Conference to our city. It is eight years since the Federation held its first conference here, and it is with very great pleasure that we are to-day privileged to receive, healthy and well developed, the promising Association formed on that occasion. I should like to remind you that Manchester cannot, as an insurance centre, claim the hoary antiquity of some other cities, and you may think it singular that the Federation of Insurance Institutes should have come into existence here instead of some more important centre of insurance life, for within my own recollection the insurance business of this district was carried on almost entirely by chief agents; there were, however, two head offices in our city, but there were only two companies who

were represented by branch establishments. It was during the period covered by the "fifties" and the "sixties" that the rapid growth of the Cotton industry and the consequent impetus given to the "home" and "shipping trade" called for a more expeditious and effective way of dealing with all kinds of insurance business. Then it was that the branch system as we know it to-day developed rapidly, and in 1863 about a dozen offices were represented here by duly equipped branches under the control of local managers, assisted by efficient staffs. It was in this year that the senior officials recognised the need of some association which might tend to promote friendly intercourse between rivals in business and the mutual exchange of technical knowledge, with a view to the more efficient conduct of the business. The formation of the Insurance Institute was the outcome of this movement. It is common knowledge that in subsequent years other Institutes of a similar character and with similar aims were established in various important centres. Each of these associations was, however, isolated, so that in course of time the need of co-operation came to be felt, and it was recognised that there would be great advantage in securing opportunities for occasional intercourse between the representative men of different parts of the country, and for a wider publication in permanent form of many valuable papers which were read at the meetings of the several Institutes and then consigned to a merely local circulation or to oblivion. Besides this, it was felt that there might be other schemes in the interests of our rising officials which might be attempted by united action. It was in this spirit, and with such aims, that the delegates appointed by each of the ten Institutes then in existence assembled here on 12th March, 1897. And now, gentlemen, on this second visit of the Conference to this city, I should like briefly to review the work done by the Federation during the eight years of its existence, and to ask you to consider whether it has justified the hopes of its founders and has successfully carried on the educational, technical, and journalistic work, as well as the personal intercourse, which it was formed to

promote. For myself, gentlemen, I unhesitatingly say that we have great cause for satisfaction and encouragement. The work which at the beginning we set ourselves to do has been carried out with thoroughness and success. The plans which were adopted at our first conference here have, so far, borne the test of time; experience has suggested some modifications and some extensions, but no radical alteration has yet been found necessary. The set of seven volumes of the Federation Journal is in itself a sufficient and lasting testimony to the value of the Federation. These volumes have placed our young men for the first time in possession of text books in which they may gather instruction in every branch of insurance business, along with the ripe experience of many of our ablest officials. Among the great variety of useful and important papers which the Journal contains, perhaps few will be found of greater interest than the excellent prize essays which appeared last year, and it was a cause of satisfaction to know that at least a dozen essays of high merit were among those received in the competition. The annual examinations which we inaugurated have been taken up with more or less heartiness at all our centres, also in London and other places where Institutes do not as yet exist. It is gratifying to see that in so many directions an interest in the study of technical knowledge has been stimulated among our young officials, who have thus helped to realise that intelligence and thoroughness must be the watchwords of those who have any ambition to do themselves credit and to secure advancement. It is pleasing also to see that our work has been appreciated by our friends in the Colonies, and that in Canada our Journal and our system of examinations have been repeated in a very efficient manner. Nor can I overlook the assistance which this Federation has been able to render to the *Insurance Clerks' Orphanage*. I do not claim that we either originated or carried out that beneficent scheme, for we held that to ensure the large success which we all desired to see it was necessary that the London offices should, in this matter, give a lead; but the Federation was the channel through which Mr. Brookes, the honoured

founder, was enabled to bring the enterprise under the favourable notice of the insurance men of the United Kingdom. In the success which has been achieved, thanks in no small measure to the influential and energetic support of its chairman, we all rejoice.

As you well know, the literary and educational work which we have been able to accomplish has entailed on many of the leading members of our Institutes a considerable amount of honorary work which has at all times been cheerfully undertaken by men who were already bearing the heat and burden of the day. But in this connection I do not feel it at all invidious to name the successive Honorary Secretaries to the Examiners, Mr. Roberts, Mr. Eddison, and Mr. Sneath. To them, in a most emphatic sense, our warmest thanks are due for labourious service most efficiently rendered. How earnestly and unselfishly they have devoted themselves to this undertaking can be but imperfectly realised by any but those who have had the opportunity of close observation; aud they richly deserve the gratitude of all the students who have derived benefit from their labours. But while reviewing the work of these eight years, and recalling pleasant memories of the annual conference which the generous hospitality of our friends at the different centres have rendered so delightful, we cannot forget that these memories are touched with the sad sense of loss. Our past presidents, Mr. Tennant and Mr. Deuchar, generously rendered us most valuable and ungrudging assistance. Their wise counsels and hearty co-operation advanced the efficiency of the Federation and extended its influence. We miss their genial presence to-day, and shall long remember their blameless character, their high ideals, and their great ability. To have known such men is one of the privileges of life, and and a pleasure which many of us should never have enjoyed had it not been for the opportunities afforded by these annual conferences. I have spoken of the past; the future rests with the members of our Institutes, and especially with our younger members, the men of the future. If I were to "dream dreams" I might imagine a Utopia in which the

Federation would attain to much greater importance; in which the managers of our offices and the great controlling authorities in the business would freely grant the immense aid which their sympathetic and cordial support would secure; in which opportunities for improving technical knowledge and general efficiency would be so universal, and so fully recognised, that an examination certificate would become as necessary to a rising insurance man as a diploma is to a doctor. But meanwhile I am content that we should endeavour to carry on steadily and with efficiency the work we have in hand, adapting our arrangements in the light of experience, and improving where we can. I hope I have vindicated my opinion that the Federation has achieved as much in the time as could have been expected, and I believe it will continue to progress as long as there is, as hitherto, an earnest self-sacrificing band of workers to carry on the enterprise.

THE INSURANCE CLERKS' ORPHANAGE.

REPORT OF THE GENERAL COMMITTEE TO THE THIRD ANNUAL GENERAL MEETING OF MEMBERS, TO BE HELD AT THE REGISTERED OFFICE OF THE INSTITUTION, 11 QUEEN STREET, CHEAPSIDE, E.C., ON WEDNESDAY, 7TH JUNE, 1905, AT 5 O'CLOCK.

THE General Committee have much pleasure in submitting their Third Annual Report to the members of the Orphanage, together with Accounts and Balance Sheet made up to the 31st March, 1905.

The total amount received during the year was £1645 0s. 11d., of which, in accordance with the Articles of Association, £581 8s. has been carried to Capital, bringing that Account up to £6455 14s. 7d.; the remaining £1063 12s. 11d., representing Revenue, brings the total Revenue Balance up to £2428 13s. 9d.

The Life Membership Subscriptions of £142 16s. were received from 31 new Life Members and from 13 Annual Members already upon the books. Annual Members contributed £719 7s., of which amount £114 6s. represents the subscriptions of 404 new members, the balance being renewed subscriptions.

The number of members, it will thus be seen, was increased by 435 during the year, the total number (allowing for lapsed subscriptions and deaths) standing at 2527.

It will be noticed that the total receipts show a falling off as compared with last year, which is explained by the fact that the figure in the last report included many large donations from companies and from prominent Insurance officials. Contributions of this nature the Committee hope to see continued. On the other hand the ordinary income (from members' annual subscriptions, donations under £20 and interest) has increased from £991 to £1064.

The various social functions organised in different parts of the Kingdom afford evidence of continued interest in the Orphanage. In this connection the General Committee thankfully acknowledge substantial aid from the following sources:—

	£	s.	d.
Birmingham Insurance Institute, Collection at Dinner - - - - - - -	£20	0	0
Newcastle Insurance Institute, Smoking Concert - - - - - - -	11	0	0
Yorkshire Insurance Institute, Concert -	22	12	0
Central Insurance Company, Collection at Staff Dinner - - - - - -	4	7	6
Commercial Union Assurance Company, Staff Smoking Concert - - - -	4	10	6
Guardian Assurance Company, Staff Smoking Concert - - - - - - -	10	4	0
Phœnix Fire Office, Staff Smoking Concert -	11	6	6
Smoking Concert, arranged by Liverpool Committee - - - - - - -	46	0	0

It is gratifying to record that during the year three companies, the Caledonian Insurance Company, Liverpool and London and Globe Insurance Company, and the Scottish Union and National Insurance Company contributed £100 each. Since the Institution was inaugurated, towards the end of 1902, the following donations have been received from 15 companies entirely without solicitation:—

Atlas Assurance Company - - - - -	£100
Caledonian Insurance Company - - -	100
Commercial Union Assurance Company -	100
County Fire Office - - - - - -	100
Liverpool and London and Globe Insurance Company - - - - - - -	100
London & Lancashire Fire Insurance Company	100
Northern Assurance Company - - -	100
Phœnix Assurance Company - - -	100
Provident Life Office - - - - - -	100
Scottish Union and National Insurance Company - - - - - - -	100
Sun Fire Office - - - - - - -	100

Union Assurance Society - - - -	£100
Westminster Fire Office - - - -	100
Essex & Suffolk Equitable Fire Insurance Company	26 5s.
AND	
State Fire Insurance Company - - -	21

The Committee would commend the claims of the Institution to the managers of other companies, the directors of which would, no doubt, desire to support the Orphanage.

The total expenditure amounted to £263 14s. 9d., of which £118 5s. was for grants made on account of Orphans.

The balance of the expenditure, £145 9s. 9d., represents printing, stationery, postages, and working expenses generally.

The sum of £1433 2s. 3d. was invested during the year, making the total investments of the Orphanage £8236 11s. 5d.

The objects which the Founders of the Institution had in view have already been realised, and there are at present six Orphans receiving the benefits of the Institution, three new cases having been accepted during the year. The General Committee desire to emphasise the views expressed in their last Report, as they are still strongly of opinion that the need of the Institution is a far larger number of annual members, whose contributions shall not be confined to the minimum of 5s. They are confident that in time the usefulness of the Orphanage will be more widely appreciated and its resources fully employed. In this connection the General Committee, taking into account the low minimum subscription required, have arrived at the conclusion, after careful consideration, that now, at the end of the third year of the Orphanage, with a membership of 2500 and invested funds of £8500, they should, in the interest of the members, require, in future, information from all candidates on the three points of age, health, and length of Insurance service, and have resolved that no application for membership will hereafter be entertained without such particulars.

The General Committee desire to take this opportunity of tendering their thanks to the members of the Local Committees in the different Insurance centres, to whose energy and enthusiasm so large a share of the present gratifying position of the Institution is due, as well as to those gentlemen who have kindly acted as Collectors in the various offices with which they are connected.

The General Committee also desire again to make their

acknowledgments to the Committee of the London Salvage Corps for the use of their premises as the Registered Office of the Institution.

A sense of obligation is also felt towards the Insurance press for prominence given to matters connected with the Orphanage, as well as for gratuitous advertisements. The value of this form of assistance is much appreciated.

The following members of the General Committee retire in accordance with the Articles of Association, and, being eligible, offer themselves for re-election, viz.: J. G. Boss, Albert D. Brookes, S. Stanley Brown, E. Colquhoun, Stenton T. Covington, and H. Foster Cutler.

The retiring Auditors, Messrs. Price, Waterhouse, & Co., whose services are honorary, being eligible, offer themselves for re-election.

SAML. J. PIPKIN, *Chairman.*

24th May, 1905.

THE INSURANCE CLERKS' ORPHANAGE.

INCOME and EXPENDITURE ACCOUNT for the Year ending 31st MARCH, 1905.

INCOME.

To Balance brought forward from last Account		£1,628 15 7
,, Subscriptions from Life Members ...	£142 16 0	
,, Donations of £20 and upwards ...	138 12 0	
,, Donations from Insurance Companies	300 0 0	
		581 8 0
,, Annual Subscriptions from Members	£719 7 0	
,, Donations under £20	138 15 3	
,, Interest on Investments and on Money on Deposit	205 10 8	
		1,063 12 11
		£3,273 16 6

EXPENDITURE.

By Transfer to General Capital Account in accordance with the Articles of Association of the Orphanage	£581 8 0
,, Working Expenses, Stationery, Printing, Postages and Petties, &c.	145 9 9
,, Grants	118 5 0
,, Balance carried to Balance Sheet	2,428 13 9
	£3,273 16 6

BALANCE SHEET, 31st MARCH, 1905.

To General Capital Account as at 31st March, 1904	£5,874	6	7			
Add Amount received during the Year, being Life Subscriptions, and Donations of £20 and upwards	581	8	0			
				£6,455	14	7
,, Balance of Income and Expenditure Account				2,428	13	9
,, Outstanding Accounts				11	15	9
				£8,896	4	1

By Investments at cost :—						
£5000 2½ per Cent. Consols ...	£4,622	10	2			
£1016 16s. 0d. Birmingham Corporation 3 per Cent. Stock	1,001	2	3			
£500 New South Wales 3½ per Cent. 1918 Stock	481	18				
£500 London, Brighton & South Coast Railway 5 per Cent. Consolidated Preference Stock	697	18	3			
£500 North Eastern Railway 3 per Cent. Debenture Stock	487	7	9			
£1000 Cape 3½ per Cent. Inscribed Stock	945	14	6			
				£8,236	11	5
,, Cash at Bank, Current Account ...	£654	3	4			
,, ,, in hand	5	9	4			
				659	12	8
				£8,896	4	1

AUDITORS' CERTIFICATE AND REPORT.

In accordance with the provisions of the Companies Act, 1900, we certify that all our requirements as Auditors have been complied with.

We have examined the above account of Income and Expenditure for the year ended 31st March, 1905, and the Balance Sheet as at that date with the books and vouchers of the Institution, and report to the Members that in our opinion the Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Institution's affairs, as shown by the books.

We have verified the Investments appearing in the Balance Sheet.

PRICE, WATERHOUSE, & CO., *Auditors.*

15th May, 1905.

THE FEDERATION OF INSURANCE INSTITUTES
OF GREAT BRITAIN AND IRELAND.

Founded 12th March, 1897. Constitution agreed to, 12th June, 1903.

CONSTITUTION.

1. The organisation shall be called "THE FEDERATION OF INSURANCE INSTITUTES OF GREAT BRITAIN AND IRELAND." Title.

2. The objects of the Federation are to encourage the study of all subjects bearing on every branch of Insurance, to promote the technical education of junior Insurance officials, and to do all such things as may be deemed desirable to advance the welfare and efficiency of the Insurance profession. Objects.

3. The Federation shall consist of Institutes, Associations, or Societies in Great Britain and Ireland established for the above-named purposes. Membership.

4. The Institutes now forming the membership of the Federation are the following, viz.:—

The Insurance Institute, Manchester.
The Insurance and Actuarial Society of Glasgow.
The Insurance Association of Manchester.
The Insurance Institute of Ireland.
The Norwich Insurance Institute.
The Birmingham Insurance Institute.
The Insurance Institute of Yorkshire.
The Insurance Institute of Bristol.
The Insurance Institute of Newcastle-upon-Tyne.
The Nottingham Insurance Institute.
The Insurance Society of Edinburgh.

5. Insurance Institutes established abroad or in any of the Colonies or Dominions of the British Empire may be affiliated

with the Federation on such terms and conditions as may be provided by the Constitution and Bye-laws, but shall have no control in the management.

6. The Institutes now affiliated with the Federation are:—

The Insurance Institute of Toronto.
The Insurance Institute of New Zealand.
The Insurance Institute of Montreal.
The Insurance Institute of South Africa.

7. The admission of new Institutes to the Federation, or of Institutes applying for affiliation, shall be by the unanimous vote of the Conference.

8. Subscribers of not less than One Guinea per annum to the Funds of the Federation shall be eligible as Honorary Members. They shall be entitled to two copies of the "Journal" for each guinea subscribed, and a list of all Honorary Members shall be published in the "Journal" each year.

Operations. 9. The operations of the Federation shall be regulated by an Annual Conference and an Executive Committee elected thereat, with such Special and Sub-committees (the Honorary Secretaries of which shall be appointed by the Conference) as may from time to time be determined upon, and may include

(*a*) The publication of a "Journal,"
(*b*) The holding of Examinations,
(*c*) The offering of Prizes for essays or research in any subject bearing on Insurance business,
(*d*) The formation of a Library of Insurance works,
(*e*) The encouragement and support of the Insurance Clerks' Orphanage and/or other charitable institution which may commend itself to the Conference, or
(*f*) Any other matter which in the opinion of the Conference may be considered desirable for the general welfare of the Federation or the Insurance profession.

Office-bearers. 10. The Office-bearers shall consist of a President, an Honorary Treasurer, and a Secretary, and of the Honorary Secretaries to all Special or Sub-committees, and shall be elected annually by the Conference, which shall also fix the remuneration of the Secretary. It shall be competent to the Conference to delegate to any Special or Sub-committee the election of one of its number as Honorary Secretary to such Special or Sub-committee.

Executive Committee. 11. The Executive Committee shall consist of two Delegates from each Institute, Association, or Society embraced in the Federation

in full membership, together with the Honorary Secretaries to all Special and Sub-committees and any others who may be appointed from time to time by the Annual Conference.

12. Any vacancy occurring in the Office-bearers or Executive shall be filled up by the Executive Committee at a meeting specially summoned for that purpose, and the appointments so made may continue in force until the next Conference. Vacancies.

13. The Examiners shall be elected annually by the Conference. Examiners

14. The Annual Conference shall consist of the Office-bearers, the President of each Institute, all Past Presidents, the Examiners for the time being of the Federation, the Honorary Secretaries of Special and Sub-committees, the Honorary Secretary of the Institute at which the Conference is held, and two Delegates from each Institute. Annual Conference.

15. At all Meetings of the Conference and the Executive Committee the Chair will be taken by the President, or, in his absence, by one of the Past Presidents, whom failing the Chairman shall be elected from among those present.

16. All voting at the Annual Conference and at meetings of the Executive Committee shall be by Institutes, one vote only being allowed to each Institute, the President having a casting but not a deliberative vote. Voting.

17. The Conference shall not exercise any authority or control over any Institute, Association, or Society embraced in the Federation except in matters directly relating to the interests of the Federation, and if any question arise in connection with this Article it shall be decided by a vote of the Conference, two-thirds majority to decide the question, which must appear in the Agenda. Authority of Conference.

18. It shall be in the province of the Federation in Conference assembled to censure any Institute, Association, or Society, or terminate its membership, should it fail to effectively maintain the objects above set forth, or introduce any practice deemed to be inconsistent therewith, or otherwise infringe any part of this Constitution, or the membership of which may be deemed to be no longer advantageous to the Federation.

19. The duties of the Secretary shall be to keep the Minutes of the Executive Committee and of the Conference, to prepare the Agenda for the same, to send out Notices of all meetings, to assist all Sub-committees when required in any of their duties, to conduct the correspondence of the Federation, and generally to do all such things as usually pertain to the duties of his office. Duties of Secretary.

Honorary Treasurer. 20. The Honorary Treasurer shall receive and give receipts for all moneys due to the Federation, and shall pay all just debts and demands owing by the Federation, and shall render an account of the same each year to the Annual Conference, such account to be made up to the 31st December in each year, and to be printed and sent by the Secretary to the Delegates a clear week before the Annual Conference.

Funds. 21. The funds of the Federation shall be derived from

(*a*) A levy laid on each of the Institutes, Associations, or Societies embraced in the Federation, the amount of such levy to be decided each year by vote of the Conference,

(*b*) The profits accruing from the sale of the "Journal," the price of which shall be fixed each year for Members and Non-Members by the Conference,

(*c*) Subscriptions received from affiliated Institutes, from Insurance Offices, and from Honorary Members.

22. The funds of the Federation may be used for any of the following purposes:—

(*a*) Printing of the "Journal" and of all reports, circulars, certificates, or other documents authorised by the Conference or Executive.

(*b*) Salaries of the Secretary or other officials authorised by the Conference.

(*c*) Any other object which may from time to time be ordered by the Conference as conducive to the well-being of the Federation in promoting its operations, as defined in Rule 9.

Meetings. 23. The Conference shall meet each year in the month of May or June in such convenient centre as may be decided by the Conference from year to year.

24. The Executive Committee shall meet at such times as may be required by the necessities of business to be transacted, and the place of meeting shall be left to the decision of the President for the time being of the Federation.

25. Fourteen clear days' notice shall be given of all meetings of the Annual Conference and of the Executive, and the Notice calling the meeting shall state the principal business which is to be brought forward; but after the business stated in the Notice convening the meeting has been finished, it will be competent for any Delegate to introduce any other business for discussion only with the consent of a majority of votes.

26. The Executive Committee shall be called at any time by the Secretary on a requisition from three or more Institutes, and such requisition must state the object for which the meeting is requested. At such Special Meetings of the Executive, the only business which may be transacted will be that stated on the Notice as the special business for which the meeting has been called.

27. The meetings of all Special and Sub-committees shall be called by the Honorary Secretary of each at such times and places as may be most convenient.

28. It will be the duty of the Executive Committee to exercise during the year such control over the work of the Federation and of all Sub-committees as may be desirable, to assist and direct when necessary such work, to deal with all matters on which an immediate decision may be required in the interest of the Federation, and to report to Conference. Duties of Executive.

29. Reports of all Special and Sub-committees to be submitted to the Conference shall be printed and in the hands of Honorary Secretaries of each Institute embraced in the Federation and Delegates one clear week before the date of meeting of the Conference. Reports for Conference.

30. The Publications Sub-committee shall submit to the Conference each year a printed report of its operations, with a list of proposed papers for the forthcoming volume of the "Journal," and any other suggestions connected therewith.

31. Subject to the provisions of the Constitution and Bye-laws and for the purpose of promoting the objects of the Federation, the Conference shall cause Examinations to be held at such places as it may think fit, and shall prepare and publish Rules to regulate such Examinations, and to define the cases and circumstances under which the said Examinations shall severally apply, the subjects which they shall respectively comprise, the fees, if any, which shall be paid or deposited by candidates in respect of such Examinations, and the nature of the certificates, if any, to be granted to successful candidates. It may vary or rescind from time to time any of the said Rules of Examination, or add thereto, in any such manner as it may think fit, and may delegate to any Committees or Sub-committees such powers and instructions as may be necessary to carry out these objects.

32. The Honorary Secretaries to the Examiners shall submit to the Conference each year a printed report of the results of the

examinations, with recommendations for the examinations in the following year, and any other suggestions connected therewith.

Audit. 33. The Treasurer's statement of accounts shall be audited each year by two honorary auditors to be elected by the Conference annually.

Bye-laws. 34. The Conference shall make and alter such Bye-laws (not inconsistent with the Constitution) as may from time to time be found necessary, but two months' notice of any Bye-law to be proposed by any Institute, or of any alteration in an existing Bye-law, must be given to the Secretary, who shall forthwith intimate the same to the Honorary Secretary of each Institute embraced in the Federation.

35. All Bye-laws and alterations thereof must be sanctioned and approved by a vote of the Institutes represented at the Conference, a majority of two-thirds being necessary.

Alteration of Constitution. 36. No alteration or addition shall be made to the Constitution except at the Annual Conference, and two calendar months' notice must be given to the Secretary in writing of any such proposed alteration or addition, and it will be the duty of the Secretary to send copies of such proposed alteration or addition forthwith to the Honorary Secretary of each Institute embraced in the Federation.

37. No alteration or addition to the Constitution shall be made unless sanctioned by a majority of two-thirds on a vote of Conference.

BYE-LAWS.

1. Institutes affiliated with the Federation shall be charged an annual subscription to be determined by Conference, and shall be entitled to one copy of the "Journal" each year per member at the same price as is charged to the members of Institutes constituting the Federation plus the cost of carriage.

2. Should a vacancy occur in any Special or Sub-committee of the Federation, or Examiners, it will be competent for such Special or Sub-committee to fill up the vacancy till the date of the next Conference.

3. The President and Secretary of the Federation for the time being shall be *ex-officio* members of all Committees and Special or Sub-committees of the Federation.

4. Should the Delegate duly appointed to attend a meeting of the Executive Committee or Conference be unable to attend, the Council of the Institute may send, as a substitute, any member of the Institute.

5. At meetings of the Executive Committee, six shall form a quorum provided that they represent not less than four Institutes. The quorum for all Special or Sub-committees shall be decided by each.

6. Candidates for the Examinations in the Fire Department must be in the employ of an Insurance Company (otherwise than a Fire Insurance Company which is not a member of the Fire Offices Committee).

7. The names of all Offices subscribing to the Federation shall be published in the "Journal" annually, also the results of the Examinations and the Examination papers.

8. Each Institute is entitled to have one copy of the "Journal" for each of its members at the reduced price as fixed by the Conference annually, it being a condition of obtaining such copies at the reduced price that no member of any Institute shall be charged more than the reduced price, as fixed by the Conference, for his copy, and that no additional copies, whether applied for by members of Institutes or others, may be supplied at less than the published price.

9. The higher officers of Insurance Companies and representatives from any affiliated Institute or any other person of distinction may be invited to the Conference by the President for the time being with the consent of the Executive.

LIFE ASSURANCE TRADING.

By A. D. LINDSAY TURNBULL, F.F.A., C.A., F.C.I.S.

A Paper read before the Insurance Society of Edinburgh, 20th December, 1904.

As I have been invited to read a paper on a subject connected with Life Assurance, and as, according to the rules of this Society, it should be of a practical nature, I feel that I cannot do better than make a few remarks on the practice of Life Insurance business, or what I prefer to call Life Assurance Trading.

I may explain at the outset that it is probable that many Actuaries have been tempted to write on this subject, but, although everyone with any experience of Life Assurance affairs can say a great deal on such matters, professional etiquette has always strictly prohibited any statements being made about the management or success of any individual office.

It is, however, no easy task to discuss practical questions without unwillingly infringing this rule indirectly.

I have found it necessary, for the purposes of this paper, in so far as they refer to initial costs and expenses, to show that certain classes of offices spend, or appear to spend, much more than others to obtain new assurances. But as these classes or groups are not specified, where expense rates are tabulated, I have been able to conceal the identity of every office. I may add that several managers, to whom I feel much indebted, have given me statistical information, which they are not in the habit of publishing, and it would be a breach of confidence on my part to use such information without great discretion.

To obtain a correct idea of the aims and objects of Insurance men, it is first advisable to divide the offices they represent into their different classes. There are great differences between offices, and what is quite right and proper for one office or class

of offices to do may be considered improper if done by others of a different description.

The principal classes of Companies and Societies in Great Britain engaged in Life Assurance business are the following:—

1. English "Proprietary" Companies, transacting Life business only.
2. Scottish "Proprietary" Companies, transacting Life business only.
3. Engilsh "Proprietary" Companies, transacting Life and Accident business.
4. Scottish "Proprietary" Companies, transacting Life and Accident business.
5. British and Irish Fire Offices, with Life departments. Some of these have also Marine, Accident, and other departments.
6. British Industrial Companies, with "Ordinary" Life departments.
7. English Mutual Societies, which do not employ Agents.
8. English Mutual Societies, paying commission to Agents.
9. Scottish Mutual Societies.
10. American Offices, transacting Life business in Great Britain.
11. Colonial and Canadian Offices, transacting Life business in Great Britain.

I have not put the Legal offices in a class by themselves, as I do not think that Life Assurance in connection with Loan and Reversionary transactions is confined nowadays to any particular set of offices.

NEW BUSINESS COMPLETED.

The following table, showing the amounts of new assurances, with relative new premiums, obtained in 1903 by these Companies, has been compiled from returns given in *The Insurance Register*, Mr. Wilkie's *Vade Mecum*, the publications of Mr. Monilaw's, and from information kindly supplied direct. All figures are net, re-assurances having been deducted. Leasehold redemption business has been omitted. The statistics of the American offices throughout the paper have been almost exclusively taken from the *Companion to Surplus Funds*.

This table is in no way intended as a comparison of anything more than the relative amounts of new assurances completed by the various classes of offices.

It is hardly necessary to mention that an abundance of new business is in itself no criterion of the success of an office: were it so, the table would not have been printed with so much detail.

There can be no harm, however, in showing incidentally that the average new premium, which Mr. Deuchar assessed in 1874 at £3 per cent. of the sum assured, is now £4 8s. 6½d. for all British offices considered, £4 6s. for the three American offices, and that the Industrial Companies and the Scottish Mutual Societies get a somewhat higher rate of premium than other offices. From this one would gather that they write a larger proportion of "provident business," that is, Whole Life and Endowment Assurance policies with profits, than other Companies, while the other Companies, and especially the Fire offices, appear to obtain a larger proportion of "commercial business," that is, non-profit policies issued in connection with loan and other business transactions. Provident business is considered safer by Actuaries than commercial business, but, as policies of the former class are nearly all effected with profits, it is a greater strain on the bonus-yielding powers of an office than commercial business, which is generally non-profit, and which, unless the lives are bad or the premiums too low, should be a great source of profit to the Company.

It is interesting to note that Proprietary Companies with Accident departments, both in England and Scotland, obtain a larger proportion of new business, relatively to their funds, than companies which do Life business only.

TABLE I.

Description of Offices.	Number of Offices considered.	Funds at end of 1903.	Renewal Premiums.	New Assurances Completed in 1903. New Sums. Net.	Ratio of New Sums to Funds.	New Premiums. Net.	Ratio of New Premiums to Renewals	Average Rate of New Premiums.
Proprietary Companies transacting Life business only—					per cent.		per cent.	per cent.
I. English	16	£51,934,382	£4,331,039	£10,355,052	19·9	£444,368	10·3	4·291
II. Scottish	4	22,834,431	1,699,497	3,843,800	16·8	161,795	9·5	4·209
Proprietary Companies doing Life and Accident business only—								
III. English	2	8,021,851	648,313	2,379,024	29·7	97,766	15·1	4·110
IV. Scottish	5	2,353,364	281,315	1,290,728	54·8	54,000	19·2	4·184
V. Life departments of British and Irish Fire Offices	19	60,638,495	4,720,245	10,910,289	18·0	442,229	9·4	4·053
VI. "Ordinary" Life departments of British Industrial Companies	7	31,385,584	4,177,398	10,912,599	34·8	567,577	13·6	5·201
English Mutual Societies—								
VII. Which do not employ Agents	4	15,899,558	912,822	1,032,774	6·5	42,527	4·7	4·118
VIII. Which employ Agents	8	31,425,937	2,235,569	5,263,578	16·7	218,074	9·8	4·143
IX. Scottish Mutual Societies	4	39,157,286	2,202,746	3,597,997	9·2	166,609	7·6	4·631
TOTAL, BRITISH	69	£263,650,888	£21,208,944	£49,585,841	18·8	£2,194,945	10·3	4·427
**All British, 1881*	*75*	...	*£10,009,748*	...	...	*£731,250*	*7·3*	...
X. American Offices	3	£231,419,359	31,699,794	£155,937,200	69·4	6,703,490	21·1	4·299
Note.—The Statistics of the Colonial Offices were not available.								
ADDENDA.								
All English and Irish Offices given above	52	182,178,477	15,652,704	37,979,137	20·8	1,696,248	10·8	4·466
All Scottish Offices given above	17	81,472,411	5,556,240	11,606,704	14·2	498,697	9·0	4·297
†*Do. do. 1873*	*15*	*23,273,443*	*2,494,615*	*7,614,763*	*32·7*	*228,433*	*9·2*	*3·000*
All British Offices transacting Life business only and employing Agents	32	145,352,036	10,468,851	23,060,427	15·9	990,846	9·5	4·297
**Do. do. 1881*	*47*	...	*6,736,170*	...	...	*499,439*	*7·4*	...

* Taken from J.I.A. XXIII., page 364 [July 1882].

† Taken from Mr. Deuchar's Paper in J.I.A., XVIII., page 331 [1874].

This may be because the Companies with Accident departments have, as a rule, not been established long enough to have large Life funds, though they are old enough to have good connections, or it may be caused, to a limited extent, by the reassurance of the fatal accident risk under Accident policies in the ordinary Life departments of the Companies in question, or it may merely mean that the fact that they do Accident business may be taken as an indication that the management is more enterprising, and, speaking generally, more ready to take chances, than in Companies transacting one class of business only.

COST OF NEW BUSINESS.

Although the success of any office, as judged by the amount of new policies written at a moderate expense, depends very much on the enterprise and energy of the manager and his staff, there is no doubt that offices of certain descriptions can obtain their new business at less cost and more readily than others. This was clearly shown in a reprint from the *Review* published in the *Journal of the Institute of Actuaries,* in July 1882 (*see* Vol. XXIII.).

Mutual Societies and Proprietary Companies.

It is generally held that it is easier to secure a proposal for a Mutual Society than for a Proprietary Company; and, when it comes to mere canvassing, the argument that "all the funds belong to the policy-holders, and all the profits are divided among them," usually has more weight than the statement that "in addition to the security of the funds of the Company, amounting in all to £——, the policy-holders have the protection afforded by the uncalled capital, amounting to £——."

But in the competition to offer the public the most assurance for the smallest premium, or perhaps it would be more correct to say—what is not quite the same thing—in the competition to offer to the most members of the public the most assurance at a reasonable premium, the Proprietary Company has often decided advantages over the Mutual Society.

If a Proprietary Company is in a position to obtain desirable proposals much cheaper than a Mutual Society, not only should the former obtain much more new business than the latter, but, provided the Company does not do an excessive amount of new business, it should even be able to give as good bonuses as the Mutual Society.

An excessive amount of new business, even though it be obtained at the abnormally low expense rate of, say 50 per cent. of the first premium, assuming the periodical valuation of policies to be made in the usual manner, is a great strain on the bonus-earning powers of an office. An excessive amount of new business, however, if obtained at a moderate cost, is, no doubt, a source of extra profit to shareholders.

Composite Companies.

There is no doubt that Companies which transact Fire and Industrial Insurance business are enabled to do Life business more economically than those Companies which have an organisation for procuring Life business only. The branch and agency systems of successful Industrial and Fire Companies require to be most elaborate, and it is easy to see that when branch managers and inspectors are engaged on one class of insurance, they can readily, and with very little additional expense, carry on another. In Fire offices, for instance, the Life department can be most thoroughly advertised, at a trifling cost, every time Fire renewal notices are sent out: and, great as are the advantages possessed by composite Companies transacting Life business in Great Britain, if they have departments for one or more other kinds of insurance, their advantages are still greater when transacting Life Insurance business under similar conditions in Asia and in other places abroad. Fortunately, however, for those connected with purely Life Companies, which are not mutual, and which have neither large funds nor other advantages, the managers of the larger Fire Insurance Companies are, by a happy provision of nature, generally experts in the more profitable business of Fire Insurance only, and as this takes up all their attention, even when they know how, they cannot be expected to take full advantage of the machinery at their disposal for increasing their Life premium income.

It is sometimes asserted, generally without reason, that some composite Companies do not charge the full amount of the Life expenses against their Life departments. The question as to how expenses should be distributed is very often a source of friction between the departments of such Companies, and, although it is only possible for their directors to divide expenses in an arbitrary manner, I think that the tendency is, if anything, to charge the Life policy-holders with too much. The common mistake is to charge the Life department with a fixed percentage

of the total premiums collected. Sometimes this fixed rate is made to cover commission. It is obvious to anybody who has studied Life Assurance accounts that a different rate of expenditure should be assessed on new and renewal premiums. Where a uniform rate is charged, the tendency is to charge too little, if much new business is done, or to charge too much, if few new policies are issued. Commission should, of course, be charged separately, but even then trouble will arise, if an inspector, or foreign agent, is paid by commission only, as what is paid to such men in commission is really in lieu of salary and therefore applicable to ordinary expenses.

In connection with the division of expenses between departments, it must not be overlooked that there is a fairly wide margin between a rate which may be considered equitable for the Life policy-holders and a rate which may be considered unfair.

Suppose a Fire Company has Life Funds amounting to, say, £3,000,000, and does a fairly large amount of good new Life business, say, enough to obtain an annual increase of premiums amounting to 10 per cent. It is possible that, on account of the Fire connection, such a Life department could be managed at, say, 11 per cent. of the total premium income without any loss to the shareholders; but it is pretty obvious that, without the assistance of the Fire department, a Company with such funds, and doing such a large amount of new business, could not possibly be managed under less than about 13 per cent. If the directors charge, say, 13 per cent. for carrying on the Life department, they may really be indirectly making a profit of 2 per cent. above the proportion of surplus which they return as divisible between shareholders and policy-holders.

On the other hand, the policy-holders have no reasonable right to expect that their affairs should be managed much cheaper than if they had insured in a Mutual Society of the same size, or even in a Proprietary Company which had no Fire department.

It would therefore appear to be very much a matter of business expediency as to how much they should be made to pay.

A similar line of argument applies to the distribution of expenses in Industrial offices, though, possibly, there the margin to be dealt with is in most cases more than 2 per cent. of the Life premium income, and may even be as much as 3 or 4 per cent., one reason for this being that in an Industrial office

may presume that all branch managers and sub-managers are "Life experts," while in Fire offices many of the branch managers only know Fire business, and have neither the time nor the inclination to master the principles of Life Insurance.

Division of Expenses.

To enable the cost of new business to be considered in an equitable manner, it is usual to allow a constant rate of expenses to be set aside as applicable to the management of the existing business, and to charge the remainder of the expenses against the new sums completed or new premiums collected.

Dr. Sprague, Mr. Macfadyen, and others, have suggested that this constant rate should be fixed at 7½ per cent. of the renewal premiums. The late Mr. David Deuchar, who was a great authority on all practical as well as theoretical questions connected with Life Assurance, appears to have considered 7¼ per cent. sufficient.

In the old days when the usual rate of commission was 10 per cent. of the first annual premium and 5 per cent. of renewal premiums, and when funds were smaller than they are now, the rate of 7½ per cent. was probably very nearly correct. It is now, I think, too high, and for most British offices from 6¼ to 6½ per cent. will, I think, be found sufficient. I prefer, however, to arrive at the rate of expenditure to be allowed for existing business in a different manner.

The following table shows the proposed division:—

[TABLE.

TABLE II.

Table suggested for finding Cost of New Life Business.

Deduct from *all* expenses—	British Offices. With Agents.	British Offices. No Agents.	American Offices.
1. Expenses *allowed* on Funds, as below:—	Per cent.	Per cent.	Per cent.
For Funds above £20,000,000 . .	·09	...	·3
10,000,000 to 20,000,000 . .	·1	...	...
5,000,000 to 10,000,000 . .	·125	·125	...
2,500,000 to 5,000,000 . .	·15	·15	...
1,000,000 to 2,500,000 . .	·2	·2	...
500,000 to 1,000,000 . .	·25	·25	...
Below 500,000 . .	·3	·3	...
Where there are Fire and other Funds the rate is assessed according to the total of the interest-earning Assets.			
2. Cost of collecting Renewal Premiums, taken as all premiums less New Premiums:—			
Allowance on Renewals of all Life Premiums above £1,000,000 . .	4·	...	6·5
500,000 to 1,000,000 . .	4·5	...	...
Below 500,000 . .	5·	2·	...
3. Commission and Expenses on Annuities:—			
Allowance on consideration. . . .	2·	1·	2·

Then divide Balance of Expenses by Net Sums completed for Cost of New Sums, or by New Premiums for proportion spent on New Business.

I propose in the first place to allow so much for the management of the funds, expense of collecting interest thereon, and for the legal costs connected with investments, the rate allowed to large offices being less than that allowed to their smaller rivals.

When applying the table I have taken the rate corresponding to *all* the interest-bearing assets of Fire and other composite Companies.

For the collection of renewals, I propose to allow a graduated scale of expenditure for the collection of *all* Life premiums, new and renewal, deducting from the allowances, so deduced, a similar rate on new premiums.

With regard to annuities, where offices do not keep a separate account for annuities I have simply deducted 2 per cent. of the consideration received, the cost of paying annuities being covered by the allowances on the funds. This allowance also provides for all expenses connected with single payment policies after the first year.

The general result of these allowances or, one might say, handicaps, is to allow from about 7 to 8 per cent. to small offices for the management of existing business, and about 6 per cent., or even less, to the large Companies.

I have found on investigation that the average rate of renewal commission is about 3 per cent. for most offices, and I have reduced the renewal allowance of the Mutual offices, which do not employ Agents, by that amount, and have allowed them only one per cent. on the consideration for annuities.

The allowances suggested in connection with American offices were based on the returns in the American "Green Book."

Incidentally it may occur to the reader that a renewal rate of 6 or 7 per cent. appears small, when compared with what is usually charged by a purchasing office for running off the business of a Company which it has bought up, or with which it has been amalgamated.

But in an amalgamation a good deal of money is generally required for legal expenses and to provide for what may be called the vested interests of directors, officials, and others, whose remuneration before the amalgamation should to a large extent have been charged against new business. And, though theoretically all compensation for the discontinuance of this remuneration should be granted by the purchasers, it is usually better for the policy-holders of the Company which is sold, to give a little more to the purchasers than may appear strictly fair, than to allow the management to struggle on and dissipate a large portion of their premiums annually in the unsuccessful pursuit of new business.

Expenses in Australasia.

The rates suggested in Table II. would not apply to Australasian offices, if one is to accept the conclusions arrived at by Mr. J. P. Moore, who recently read a very able paper on this subject, entitled "New Ordinary Business and its Cost in Australasia." Although one naturally hesitates to criticise figures which have been brought out, evidently with great care and after much thought, by an expert who is on the spot, it does

not appear, assuming that the conditions of Life Insurance business in Australasia are something like what they are in Great Britain and America, that the conclusions arrived at by Mr. Moore as to the cost of new business are altogether in accordance with his table of analysed expenses. He is reported as having stated that Australasian new business costs from "75 to 100 per cent. of the new annual premiums," and "that the renewal business is conducted at a cost of somewhat over 10 per cent." He appears, however, to debit too large a proportion of salaries to renewals. Nothing for the use of showy office buildings, and similar outlay, appears to be charged by him against new business; and it is interesting to note in the following statement that if 8·7 per cent., which is brought out in Table III. as a fair rate for good American offices, is charged on renewal premiums for working existing business, the total cost of new premiums amounts to 105·2 as against the American rate of 106·5.

Australasian Offices—Year 1902.

Figures taken from report in *The Insurance Observer.*

Total Expenses . .	£631,898	New Premiums.	
Less 2 per cent. on the consideration for Annuities . .	1,860	Single,	£15,933
		Annual,	337,310
	£630,038		£353,243
Deduct "American rate" of 8·7 per cent. on £2,970,371 of Renewals . .	258,422		
Cost of new business	£371,616		

which equals 105·2 per cent. on new premiums.

As there appears to be no reason to suppose that the cost of collecting renewal premiums and superintending funds is much greater in Australasia than in the United States, the cost of new assurances in both places is probably about the same, although, according to Mr. Moore's figures, the percentage of total expenses on total premiums received in Australasia is about 19 per cent. only, as against 25·8 of the three American offices: while the lapse rate in Australasia on or before the due date of the premium for the second year is nearly 50 per cent., that of seventy-six selected American offices, according to him, is about

35 per cent., and that of British offices, according to Mr. King's figures of 1903 (*Journal of the Institute of Actuaries*, Vol. XXXVII., p. 463), about 10 per cent. or less.

Table III. shows the cost of new Life business completed by offices trading in Great Britain and Ireland during 1903. The rates were worked out in the manner explained in Table II. The figures of the nine classes, or groups, of British offices detailed in Table I. are given, but for obvious reasons it was considered desirable not to identify the groups when publishing the table. It is interesting to note that, when an attempt is made to estimate the cost of the new policies written by the three American offices, it makes comparatively little difference whether about nine per cent. or five per cent. on renewals is assumed as the cost of working existing business. This is because such a large portion of their total premium income consists of new premiums.

It is somewhat unsatisfactory to see that one class of British offices, designated, for purposes of reference, Class "J," appears to spend more to secure new policies than the three American offices. Turning to the portion of the table which deals with all British offices transacting Life business only and employing Agents, one observes that they, on the average, have a higher expense rate and pay more for new business than the group of all British offices, which includes the composite Companies. The important point, however, in connection with this part of the table is that the cost of acquiring new business is about the same for offices, working under similar conditions, whether they do a large amount or a small amount. It used to be considered that, on the whole, it was most economical to do from £350,000 to £500,000 of new assurances, but it now appears that the most economical amount must be between £500,000 and £750,000, unless a very much greater amount of, say, £2,000,000 or more is completed, or unless no special efforts at all are made to extend the Company's connection.

Referring to the Addenda, it will be seen that the total expense rate of all British offices is very little more now than in 1881, but that the cost per cent. of new business, as assessed on new premiums, is less than formerly, on account of the average new premium being now considerably larger than it was twenty-three years ago.

It is again somewhat unsatisfactory to find that all British

TABLE III.

TABLE SHOWING COST OF NEW LIFE BUSINESS IN 1903, the rates being arrived at in the method suggested in Table II.

Offices.	Rate of all Life (Less Annuity) Expenses on all Life Premiums.	New Assurances, Net.	Cost of New Assurances. On Sums.	Cost of New Assurances. On First Premiums.	Ratio of balance of Expense to Renewal Premiums.
	Per cent.		Per cent.	Per cent.	Per cent.
All British Offices considered—					
The 9 classes of British Offices, described above, arranged according to cost of new Assurances. A	6·1	£ ...	1·4	34·6	4·7
B	9·9	...	2·4	46·1	5·0
C	16·0	...	2·6	62·6	7·1
D	12·8	...	3·3	80·8	6·5
E	13·4	...	3·4	81·5	6·8
F	11·3	...	3·5	76·6	6·4
G	18·0	...	3·9	95·5	6·3
H	16·0	. .	4·6	106·9	6·7
J	17·6	...	5·7	135·7	6·4
Total of British Offices	13·1	£49,585,841	3·6	80·2	6·2
All Scottish Offices . . .	14·2	£11,606,704	4·3	101·0	6·4
The 3 American Offices—					
1. With British allowances for working existing business . . .	25·8	155,937,200	5·4	125·6	4·7
2. With American allowances			4·6	106·5	8·7
3. Allowing 6½ per cent. on Renewals . . .			5·0	116·9	6·5
All British Offices doing Life business only and employing Agents—					
New Sums above £2,000,000 .	17·5	6,535,051	3·7	83·3	6·0
£1,000,000 to £2,000,000 .	13·7	4,161,339	5·4	130·9	5·8
750,000 to 1,000,000 .	13·7	2,636,233	4·4	104·3	6·4
500,000 to 750,000 .	14·1	5,935,773	3·9	85·7	7·2
350,000 to 500,000 .	14·8	1,830,750	4·9	123·6	7·2
200,000 to 350,000 .	17·3	1,482,966	5·5	145·5	7·5
Less than 200,000 .	12·2	478,315	3·6	80·8	8·1
Total	14·8	£23,060,427	4·3	100·9	6·6
		ADDENDA.			
All British Offices, 1881 . .	13·0	(not given)	[3·0?]	91·2	7·5
Do. 1903, by same method	13·1	49,585,841	3·0	67·3	7·5
All Scottish Offices, 1873 .	13·3	7,614,763	2·4	79·6	7·25
Do. 1903, by same method	14·2	11,606,704	3·9	91·2	7·25
	[Gross	12,504,631	3·6]		
All British Offices doing Life business only and employing Agents, 1881 . .	14·1	(not given)	[3·5?]	103·7	7·5
Do. 1903, by same method	14·8	23,060,427	3·9	91·5	7·5

offices, which do Life business only and employ Agents in the usual manner, have found it necessary to considerably increase their expense rates over the same period, and apparently to pay more per cent. for new sums, or only a little less of their new premiums, although the premiums must be considerably larger than they were in 1881.

Scottish Offices. It is rather vexing to observe that the Scottish expense rates appear to be going up considerably. The Scottish rate of expenditure on the total premium income, and the cost of new business, whether taken on new sums or on new premiums, have considerably increased in the last thirty years, and, besides, if a reference is made to Table I., it appears that they do a relatively smaller amount of new business than the English offices, though they pay more to get it. To all Scotsmen this will be somewhat distressing, particularly when we remember that Life Insurance is what might be called one of our national industries, and that Scotsmen are to be found in important positions in Assurance offices all over the world.

Careful investigation, however, will show that things are a good deal better than they appear, and when comparing English and Scottish expense rates it must not be overlooked that the group of Scottish offices is complete, while the statistics of one or two small English offices were not available. The English rates, therefore, are a little too favourable.

It is probable that the apparent increase of expenditure is caused by the large amount of Indian and other foreign business now written by some of the Scottish offices. This can only be acquired at a high rate of expenditure, and although the extra expenditure is invariably provided for by loading the premiums to meet local conditions, unsatisfactory averages are bound to be brought out when a comparison is made between, say, a Scottish office doing a large amount of foreign business and another Scottish or English office doing home business only. Another cause may possibly be that Scottish offices, as a rule, for various reasons, do not get their fair share of reassurance business from their English friends.

It may be added that, as there was some difficulty when preparing the list of Scottish offices, in deciding as to whether one or two companies were Scotch or English, the list was made up in a similar manner to that given by Mr. Deuchar thirty years ago. Better averages would have been brought out had all British offices managed by Scotsmen been included.

The expenses of Scottish offices, however, are a little lower than those of all British offices doing Life business only.

American Offices.

It is somewhat unprofitable and not altogether pleasant to discuss the extravagance of the American offices which trade in Great Britain. It is, no doubt, unfair to judge them by their total expense rate alone, and due allowance must be given for the large amount of new business which they undoubtedly complete. But, when every allowance is made, it is clear, as is shown in Table III., that the cost of their new assurances, and the amount which they spend on working their existing business, is much more than that incurred by almost all British offices. One is almost inclined to think that, if money is wasted, it is mostly wasted at their head offices in connection with the management of their existing business, and that in their endeavours to increase their premium income not so much money is thrown away by their branch managers as is generally supposed. There is little doubt that they can obtain new business in Great Britain, and particularly in London, of a provident nature from good people a great deal cheaper than they can acquire the same class of business in their own country, or in other places where they trade, and their British policy-holders are probably better "lives" than are any others they insure. It is also probable that, owing to their better organised and harder-driven "field-men," they acquire their English business cheaper than some British offices.

These are reasons why they come here.

Thinking of them only as traders, and, to use one of their favourite expressions, "foreigners," this is certainly to their credit. It is unsatisfactory, however, to us to think that so many members of the British public are willing to pay for the privilege of assisting the Americans to reduce, or average down, the more heavy expense rate incurred in connection with their home business. It is also unsatisfactory to feel that the British contributions help to pay for the losses caused by the heavier mortality experienced under policies issued by the Americans to their own countrymen and to people in Asia and on the Continent of Europe, who live under much less favourable conditions.

TOTAL COST OF NEW BUSINESS.

Tables IV., V., VI., VII., VIII., IX., and X. have been prepared to enable one to consider the total initial cost of new assurances in a complete manner.

Table IV. shows the amount of the average office premium, and enables a comparison to be made between the total number of premiums received and the total amount paid in commission in one, five, or ten years. Ordinary rates of commission are given, and also, for purposes of comparison, special rates, such as are allowed to foreign representatives or others to whom districts are "farmed out," and who are paid by commission. It is hardly necessary to mention that when arranging terms of commission it is better, if possible, to offer a liberal rate on renewals rather than a heavy initial commission, because the larger the initial commission the heavier the rate of lapse.

[TABLE.

TABLE IV.

COMMUTED VALUES OF COMMISSION, OF TOTAL COST OF COMMISSION, also PRESENT VALUE OF AVERAGE OFFICE PREMIUMS for £100, at various ages at entry, all discounted by the $O^{[m]}$ $3\frac{1}{2}$ per cent. Table.

	Home and Foreign Rates of Commission on Premiums for first and subsequent years.	Whole Life (Full Profits).			hole Life (Discounted Bonus).			Endowment Assurances (Full Profits).	
		25 at entry.	35 at entry.	45 at entry.	25 at entry.	35 at entry.	45 at entry.	25 at 55.	35 at 60.
	Average Annual Office Premiums taken at	£2·1568 or £2 3s. 1d.	£2·7914 or £2 15s. 10d.	£3·8071 or £3 16s. 2d.	£1·7517 or £1 15s. 0d.	£2·2760 or £2 5s. 6d.	£3·1632 or £3 3s. 3d.	£3·2588 or £3 5s. 2d.	£4·1415 or £4 2s. 10d.
ONE YEAR.	£1 down and $2\frac{1}{2}$ °/. on Renewals	£1·000	£1·000	£1·000	£1·000	£1·000	£1·000	£1·000	£1·000
	£1 10s. „ $2\frac{1}{2}$ „	1·500	1·500	1·500	1·500	1·500	1·500	1·500	1·500
	10 °/. „ 5 „	·216	·279	·381	·175	·228	·316	·326	·414
	25 „ „ 5 „	·539	·698	·952	·438	·569	·791	·815	1·035
	50 „ „ 5 „	1·078	1·396	1·904	·876	1·138	1·582	1·629	2·071
	75 „ „ $2\frac{1}{2}$ „	1·618	2·094	2·855	1·314	1·707	2·372	2·444	3·106
FIVE YEARS.	£1 down and $2\frac{1}{2}$ °/. on Renewals	£1·196	£1·253	£1·343	£1·159	£1·206	£1·285	£1·296	£1·376
	£1 10s. „ $2\frac{1}{2}$ „	1·696	1·753	1·843	1·659	1·706	1·785	1·796	1·876
	10 °/. „ 5 „	·608	·785	1·067	·493	·640	·886	·918	1·165
	25 „ „ 5 „	·931	1·204	1·638	·756	·982	1·361	1·407	1·786
	50 „ „ 5 „	1·470	1·902	2·590	1·194	1·551	2·152	2·221	2·822
	75 „ „ $2\frac{1}{2}$ „	1·814	2·347	3·198	1·473	1·913	2 657	2·740	3·482
	Present Value of 5 Premiums.	*9·999*	*12·916*	*17·532*	*8·121*	*10·531*	*14·567*	*15·108*	*19·163*
TEN YEARS.	£1 down and $2\frac{1}{2}$ °/. on Renewals	£1·400	£1·515	£1·691	£1·325	£1·420	£1·574	£1·605	£1·764
	£1 10s. „ $2\frac{1}{2}$ „	1·900	2·015	2·191	1·825	1·920	2·074	2·105	2·264
	10 °/. „ 5 „	1·016	1·308	1·762	·825	1·067	1·464	1·536	1·941
	25 „ „ 5 „	1·340	1·727	2·333	1·088	1·408	1·939	2·025	2·563
	50 „ „ 5 „	1·879	2·425	3·285	1·526	1·977	2·730	2·839	3·598
	75 „ „ $2\frac{1}{2}$ „	2·018	2·609	3·546	1·639	2·127	2·946	3·049	3·870
	Present Value of 10 Premiums.	*18·169*	*23·378*	*31·431*	*14·756*	*19·061*	*26·115*	*27·452*	*34·685*

TABLE V.

INITIAL LIABILITY TO PROVIDE FOR RESERVES REQUIRED BY NEW POLICIES OF £100, if valued in the usual manner before a Distribution of Profits at the end of 1, 5, or 10 years, no Reserves being made for Bonuses accrued, if any; or, Present Value of O^m 3 per cent. Reserves at the end of 1, 5, or 10 years discounted by the $O^{[m]}$ 3½ per cent. Table.

Valuation at end of	Whole Life (Full Profits or Discounted Bonus).			Endowment Assurances (Full Profits).	
	25 at entry.	35 at entry.	45 at entry.	25 at 55.	35 at 60.
ONE YEAR . .	1·075	1·425	1·962	2·010	2·588
FIVE YEARS .	4·718	6·216	8·403	9·063	11·553
TEN YEARS .	7·969	10·361	13·364	15·752	19·885

Table V. shows the initial liability which is required on the issue of a policy to provide for the reserves at future valuations. The valuations are supposed to be made at the end of one, five, or ten years, and the policies are assumed to be valued by the O^m table at 3 per cent. interest and by the formulæ $(1\cdot03)^{\frac{1}{2}}\ {}_nV_x$ for Whole Life, and ${}_nV_{x:\overline{t|}}$ for Endowment Assurance Policies. These reserves are discounted by the $O^{[m]}$ 3½ per cent. table. It must be noticed, however, that no extra reserve is made to provide for Bonuses accrued or declared, if any.

Table VI. is the corresponding table of *Minimum* Surrender Values supposed to be payable at the rate of 30 per cent. of the full office premiums. They are also discounted to the date of the issue of the policy. Nothing is given for Bonuses accrued, if any.

TABLE VI.

Initial Liability to provide for a Minimum Surrender Value of 30 per cent. of the full Office Premiums, to be paid under Policies of £100 at the end of 5 or 10 years from date of issue, all discounted by the O[m] 3½ per cent. Table, nothing being given for Bonuses accrued, if any.

Years in Force or Annual Premiums Paid.	Whole Life (Full Profits).			Whole Life (Discounted Bonus). Surrender Value as for Policies with full Profits, less the difference between a full Office and a D.B. Premium, accumulated at 4½ per cent. interest.			Endowment Assurances (Full Profits).	
	25 at entry.	35 at entry.	45 at entry.	25 at entry.	35 at entry.	45 at entry.	25 at 55.	35 at 60.
FIVE YEARS	2·657	3·418	4·590	·755	1·013	1·631	4·015	5·071
TEN YEARS	4·314	5·477	7·123	·846	1·148	1·966	6·518	8·125

TABLE VII.

INITIAL SURPLUS OR **Deficiency** ON NEW POLICIES, on the supposition that they will be valued at the end of 1, 5, or 10 years, allowing for commission only, at various rates, and early claims, all discounted to date of issue by the O[m] 3½ per cent. Table.

The Reserve values are calculated by the O^m 3 per cent. Table, as in Table VIII.

Deficiency is in black type.

	Rates of Commission.	Whole Life (Full Profits).			Whole Life (Discounted Bonus).			Endowment Assurances (Full Profits).	
		25 at entry.	35 at entry.	45 at entry.	25 at entry.	35 at entry.	45 at entry.	25 at 55.	35 at 60.
ONE YEAR.	£1 and 2½ per cent.	**·194**	·011	·296	**·599**	**·504**	**·348**	**·027**	·198
	10 per cent. and 5 per cent.	·590	·732	·915	·226	·268	·336	·647	·784
	25 ,, ,, 5 ,,	·267	·313	·344	**·037**	**·073**	**·139**	·158	·163
	50 ,, ,, 5 ,,	**·272**	**·385**	**·608**	·475	**·642**	**·930**	**·656**	**·873**
FIVE YEARS.	£1 and 2½ per cent.	1·867	2·676	3·673	·026	·338	·766	2·531	3·463
	10 per cent. and 5 per cent.	2·455	3·144	3·949	·692	·904	1·165	2·909	3·674
	25 ,, ,, 5 ,,	2·132	2·725	3·378	·429	·562	·690	2·420	3·053
	50 ,, ,, 5 ,,	1·593	2·027	2·426	**·009**	**·007**	**·101**	1·606	2·017
TEN YEARS.	£1 and 2½ per cent.	3·872	5·108	6·492	·534	·886	1·293	5·167	6·642
	10 per cent. and 5 per cent.	4·256	5·315	6·421	1·034	1·239	1·403	1·236	6·465
	25 ,, ,, 5 ,,	3·932	4·896	5·850	·771	·898	·928	4·747	5·843
	50 ,, ,, 5 ,,	3·393	4·198	4·898	·333	·329	·137	3·933	4·808

TABLE VIII.

TOTAL INITIAL SURPLUS OR **Deficiency** ON NEW POLICIES, on the supposition that they will be valued at the end of 1, 5, or 10 years, allowing for expenses at various rates, and early claims, all discounted to date of issue by the $O^{[m]}$ $3\frac{1}{2}$ per cent. Table.

The Reserve Values are calculated by the O^{m} 3 per cent. Table, no additional reserve being provided for bonuses accrued, if any.

Deficiency is in black type.

	Expenses on Renewals $6\frac{1}{2}$ per cent. throughout, the cost of new Assurances being	Whole Life (Full Profits). 25 at entry.	Whole Life (Full Profits). 35 at entry.	Whole Life (Full Profits). 45 at entry.	Whole Life (Discounted Bonus). 25 at entry.	Whole Life (Discounted Bonus). 35 at entry.	Whole Life (Discounted Bonus). 45 at entry.	Endowment Assurances (Full Profits) 25 at 55.	Endowment Assurances (Full Profits) 35 at 60.
ONE YEAR.	$2\frac{1}{2}$ per cent.	**1·694**	**1·489**	**·204**	**2·099**	**2·004**	**1·848**	**1·527**	**1·302**
	3 ,,	**2·194**	**1·989**	**1·704**	**2·599**	**2·504**	**2·348**	**2·027**	**1·802**
	$3\frac{1}{2}$,,	**2·694**	**2·489**	**2·204**	**3·099**	**3·004**	**2·848**	**2·527**	**2·302**
	4 ,,	**3·194**	**2·989**	**2·704**	**3·599**	**3·504**	**3·348**	**3·027**	**2·802**
	5 ,,	**4·194**	**3·989**	**3·704**	**4·599**	**4·504**	**4·348**	**4·027**	**3·802**
	6 ,,	**5·194**	**4·989**	**4·704**	**5·599**	**5·504**	**5·348**	**5·027**	**4·802**
FIVE YEARS.	$2\frac{1}{2}$ per cent.	·053	·771	1·624	**1·729**	**1·493**	**1·190**	·557	1·363
	3 ,,	**·447**	·271	1·124	**2·229**	**1·993**	**1·690**	·057	·863
	$3\frac{1}{2}$,,	**·947**	**·229**	·624	**2·729**	**2·493**	**2·190**	**·443**	·363
	4 ,,	**1·447**	**·729**	·124	**3·229**	**2·993**	**2·690**	**·943**	**·137**
	5 ,,	**2·447**	**1·729**	**·876**	**4·229**	**3·993**	**3·690**	**1·943**	**1·137**
	6 ,,	**3·447**	**2·729**	**1·876**	**5·229**	**4·993**	**4·690**	**2·943**	**2·137**
TEN YEARS.	$2\frac{1}{2}$ per cent.	1·731	2·785	3·887	**1·486**	**1·285**	**1·125**	2·699	3·921
	3 ,,	1·231	2·285	3·387	**1·986**	**1·785**	**1·625**	2·199	3·421
	$3\frac{1}{2}$,,	·731	1·785	2·837	**2·486**	**2·285**	**2·125**	1·699	2·921
	4 ,,	·231	1·285	2·387	**2·986**	**2·785**	**2·625**	1·199	2·421
	5 ,,	**·769**	·285	1·387	**3·986**	**3·785**	**3·625**	·199	1·421
	6 ,,	**1·769**	**·715**	·387	**4·986**	**4·785**	**4·625**	**·801**	·421

TABLE IX.

Maximum Profit or **Minimum Loss** on Surrender of New Policies at the end of 1, 5, or 10 years, after providing for expenses at various rates, and early claims, all discounted to date of issue by the O[m] 3½ per cent. Table.

Surrender Values are taken at 30 per cent. of the Premiums paid, no Surrender Value being paid on Policies only one year in force, and no additional value being given for Bonuses accrued, if any.

Loss is in black type.

	Expenses on Renewals 6¼ per cent. throughout, the cost of new Assurances being	Whole Life (Full Profits).			Whole Life (Discounted Bonus).			Endowment Assurances (Full Profits).	
		25 at entry.	35 at entry.	45 at entry.	25 at entry.	35 at entry.	45 at entry.	25 at 55.	35 at 60.
ONE YEAR.	2½ per cent.	**·619**	**·064**	·758	**1·024**	**·579**	·114	·483	1·286
	3 ,, ...	**1·119**	**·564**	·258	**1·524**	**1·079**	**·386**	**·017**	·786
	3½ ,, ...	**1·619**	**1·064**	**·242**	**2·024**	**1·579**	**·886**	**·517**	·286
	4 ,, ...	**2·119**	**1·564**	**·742**	**2·524**	**2·079**	**1·386**	**1·017**	**·214**
	5 ,, ...	**3·119**	**2·564**	**1·742**	**3·524**	**3·079**	**2·386**	**2·017**	**1·**
	6 ,, ...	**4·119**	**3·564**	**2·742**	**4·524**	**4·079**	**3·386**	**3·017**	**2·214**
FIVE YEARS.	2½ per cent.	2·114	3·569	5·437	2·234	3·710	5·582	5·605	7·845
	3 ,, ...	1·614	3·069	4·937	1·734	3·210	5·082	5·105	7·345
	3½ ,, ...	1·114	2·569	4·437	1·234	2·710	4·582	4·605	6·845
	4 ,, ...	·614	2·069	3·937	·734	2·210	4·082	4·105	6·345
	5 ,, ...	**·386**	1·069	2·937	**·266**	1·210	3·082	3·105	5·345
	6 ,, ...	**1·386**	·069	1·937	**1·266**	·210	2·082	2·105	4·345
TEN YEARS.	2½ per cent.	5·386	7·669	10·128	5·637	7·928	10·273	11·933	15·681
	3 ,, ...	4·886	7·169	9·628	5·137	7·428	9·773	11·433	15·181
	3½ ,, ...	4·386	6·669	9·128	4·637	6·928	9·273	10·933	14·681
	4 ,, ...	3·886	6·169	8·628	4·137	6·428	8·773	10·433	14·181
	5 ,, ...	2·886	5·169	7·628	3·137	5·428	7·773	9·433	13·181
	6 ,, ...	1·886	4·169	6·628	2·137	4·428	6·773	8·433	12·181

TABLE X.

SUPPLEMENTARY TABLE SHOWING PRESENT VALUE OF LIABILITY TO MEET EARLY CLAIMS UNDER POLICIES FOR £100, or Net Single Premium to insure £100 by the $O^{[m]}$ 3½ per cent. Table; also Present Value of Expenses, at various rates, on Renewal Office Premiums.

		Whole Life (Full Profits).			Whole Life (Discounted Bonus).			Endowment Assurances (Full Profits).	
		25 at entry.	35 at entry.	45 at entry.	25 at entry.	35 at entry.	45 at entry.	25 at 55.	35 at 60.
ONE YEAR.	Net Single Premium = $V\frac{1}{2}\, q[x]$.	·276	·355	·549	·276	·355	·549	·276	·355
FIVE YEARS.	Net Single Premium . . .	2·218	2·771	4·113	2·218	2·771	4·113	2·218	2·771
4 Renewals to pay.	Value of expenses at								
	5 per cent. on Renewals .	·392	·506	·686	·318	·413	·570	·592	·751
	6¼ ,, ,, .	·510	·658	·892	·414	·537	·741	·770	·976
	7½ ,, ,, .	·588	·759	1·029	·478	·619	·855	·889	1·125
	8¾ ,, ,, .	·667	·861	1·167	·541	·702	·969	1·007	1·277
	10 ,, ,, .	·784	1·012	1·372	·637	·826	1·140	1·185	1·502
	12 ,, ,, .	·941	1·215	1·647	·764	·991	1·368	1·422	1·803
TEN YEARS.	Net Single Premium . . .	4·928	6·394	9·884	4·928	6·394	9·884	4·928	6·394
9 Renewals to pay.	Value of expenses at								
	5 per cent. on Renewals .	·801	1·029	1·381	·650	·839	1·148	1·210	1·527
	6¼ ,, ,, .	1·041	1·338	1·796	·845	1·091	1·492	1·573	1·985
	7½ ,, ,, .	1·201	1·544	2·072	·975	1·259	1·721	1·814	2·291
	8¾ ,, ,, .	1·361	1·750	2·348	1·105	1·427	1·951	2·056	2·596
	10 ,, ,, .	1·601	2·059	2·762	1·300	1·679	2·295	2·419	3·054
	12 ,, ,, .	1·921	2·470	3·315	1·561	2·014	2·754	2·903	3·665

the figures in Tables VIII. and IX. It must be remembered, however, that the reserve values and the surrender values given are minimum values, and that no Bonuses are alloted to the new policies under consideration.

CONCLUSIONS ARRIVED AT.

From these tables the following conclusions may be arrived at:—

1. Under ordinary circumstances all new policies are a loss for the first year.

2. Where an average rate of expenditure of 3½ per cent. on the sum assured and 6½ on renewal premiums is paid, most policies are a loss for the first five years, unless they lapse or are surrendered. If they are for the Whole of Life and are surrendered, they will also be a loss if, say, at the end of the fifth year, instead of the minimum surrender values mentioned of 30 per cent. of the premiums paid, a more liberal value of, say, 60 per cent., to cover Bonuses accrued, is allowed.

3. If no Bonuses are allotted, policies become profitable to economically managed offices in about seven years, whether they are kept up or surrendered.

4. If Bonuses, however, are allotted equal to only 20 per cent. of the premiums paid, all new policies receive more than their contributions theoretically justify on a valuation being made at the end of ten years, or at any earlier date.

5. Where offices pay as much as 5 or 6 per cent. of the sum assured in securing new business, new policies are losing transactions for ten years, unless they lapse or are surrendered, and even then Ordinary Whole Life policies will be losing transactions unless the surrender values paid are lower than those usually given by offices of good repute.

6. Policies do not begin to earn their own Bonuses in extravagant offices until more than ten premiums have been paid (possibly until more than fifteen or more premiums are paid), unless they are for short-term Endowment Assurance, or issued under other special conditions.

7. Discounted Bonus policies appear to be a strain on the office all the time they are on the books, but, if specially low surrender values are given, as is justified by the nature of such contracts, there is more profit made from them on surrender after the first year or two than from full-profit policies.

8. Heavy initial expenditure, if it is assessed on the sums assured, is not such a strain as regards Endowment Assurance policies, which, of course, have large premiums, as with Ordinary Whole Life policies: but even if, instead of measuring the initial expenditure at, say, 3, 4, or 6 per cent. on the sum assured, it be taken as a percentage of the first premium, this theory will not be materially altered.

9. Where offices commit themselves to pay liberal surrender values, and at the same time spend much money in acquiring their new business, they put themselves in a very dangerous position, as they throw away their chance of recovering themselves by making profits on surrenders and on lapses.

10. The present practice of giving, and in some cases guaranteeing, large surrender values from the outset on new policies is very much overdone. It is, no doubt, very charitable to the policy-holder who has only recently come on the books, but it is a serious imposition on the other policy-holders, who have to contribute to the unavoidable loss caused by such surrenders.

11. Mr. King has shown that according to the O^m experience (*Journal of the Institute of Actuaries*, Vol. XXXVII., p. 464), if mortality be ignored, the period for which a policy effected by a life aged 30 may be expected to remain on the books is about twenty-four years. This is probably, as already explained, a favourable estimate. As regards extravagant offices, and offices which for other reasons cannot be considered first class, the average expectation may be as low as twenty years or less. As, according to section 6, policies in such offices must remain on the books more than ten years before they begin to earn their Bonuses, the outlook for the policy-holders is not promising.

12. "Profit from interest" is not likely to assist the policy-holders in extravagant offices to any great extent, because the average size of reserves in such offices is bound to be small on account of the heavy cash outlay and the heavy lapse rate.

13. The policy-holder in an extravagant American office, who intends to keep up his policy, is in a very unsatisfactory, if not hazardous, position, because (1) of the heavy American lapse rate, the lapse rate of American Offices for the first annual renewal alone being more than the average lapse rate of British Offices for ten years; because (2) the Americans have now little opportunity of making profits from lapses and surrenders, on account of the restrictions and regulations in certain States, and because they

now often guarantee heavy surrender values and other options, the guaranteed surrender values being sometimes larger than the valuation reserves for the sum assured, and because (3), as explained in section 12, with policies of short duration they can make little profit from interest.

The Americans themselves have even contended in the past that, where cash surrender values are guaranteed, there is always the danger of a "run" on the office in the event of a financial crisis.

DIVISIBLE SURPLUS.

A still more difficult subject than the cost, or even value of new business, is the problem as to how one should measure the bonus-yielding powers of an office, or, in other words, decide whether any Office A is in a position to pay more in return for premiums received from a participating policy-holder than any other Office B.

I will allow that a canvasser in the employment of either Office, A or B, can solve the problem to his own satisfaction, and, if he is an eloquent man, convince the possible proposer that his opinion is correct in a few minutes. A good canvasser must always appear to think, and, if he is to be really successful, actually think, that the office which he represents is the best.

It is probable that if any "outside" man, or even one engaged in actuarial work, remains long enough in the employment of one office, even if that office be weak, and pay little or no bonus, he will gradually learn to think, and eventually become convinced, that the office for which he works is the best on earth. To an Actuary, however—and this is probably the reason why an Actuary is seldom ever a good canvasser—the problem appears to be too complicated, and there must always be many points for his consideration before he can come to a conclusion on the merits of any office.

The following simple formulæ may, I think, be applied for finding, roughly, which of two offices is likely to give better results :—Let Acb represent the ratio which the Surplus, divisible among participating policy-holders, bears to premiums paid by them in Office A. Cb is not meant to represent the rate of Cash Bonus per average premium, unless it happens that the bonuses be declared in cash. Cb will generally be a little larger than the average cash bonus, as in most offices the surplus applicable to

policy-holders is converted into Reversionary bonuses at a low rate of interest, and, if these Reversionary bonuses are taken in cash, their cash equivalents are discounted at a fairly high rate of interest, and the small profit made in this manner helps to provide for the bonuses at the next Distribution.

Now in most cases, if Acb be greater than Bcb, Office A will give better terms than Office B, as the conditions on which policies may be surrendered in either office, or otherwise dealt with, may be considered for all practical purposes similar.

First Test. 1. If the rate of total expenditure to Life premium income in Office A is 11 per cent., and that of Office B only 10 per cent., then

$$\text{Acb} : \text{Bcb} :: (100-11) : (100-10) \quad . \quad . \quad . \quad (1)$$
$$\text{or} \quad :: \quad 89 : 90$$

and Office B will appear to be the better office.

If, however, owing to the slight increase in expenditure, Office A obtains a much larger amount of new business than Office B, and if both make their valuations in the usual manner, it is quite possible that on account of the so-called "Mortality profit," or what may be more accurately termed "apparent profit on account of suspended mortality," Office A may give larger bonuses than Office B. But this special source of profit may disappear in a few years. Or again, if Office A secures much more new business than Office B, either on account of its additional expenditure, or for other reasons, the average policy-holder in Office A will probably be younger than the average policy-holder in Office B, and if both offices divide their profits in Reversionary additions, it will cost less to give a Reversionary Bonus of, say, 30s. per cent. to the average policy-holder of Office A than it will to the average policy-holder of Office B, so that the policy-holders in Office A may be allotted larger Reversionary Bonuses than the policy-holders in Office B.

These questions, however, are most difficult and complicated, and it is preferable, and more to the purpose, to consider somewhat simpler modifications of the formula.

Second Test. 2. If, however, in Office A the shareholders are allotted one-tenth of the divisible surplus, while in Office B the shareholders get one-fifth, then, all other things being equal,

$$\text{Acb} : \text{Bcb} :: \left(1-\frac{1}{10}\right) : \left(1-\frac{1}{5}\right) \quad . \quad . \quad . \quad (2)$$

$$\text{or} \quad :: \quad 9 \quad : \quad 8$$

and Office A appears to give better terms.

Third Test. 3. Again, if 95 per cent. of the premium income of Office A is received under participating policies, while 72 per cent. only of B's premium income is with profits, then

$$\text{Acb} : \text{Bcb} :: \frac{100}{95} : \frac{100}{72} \quad . \quad . \quad . \quad (3)$$

$$\text{or} \quad :: 72 : 95$$

and the policy-holders in Office B appear to be in a position to get more profits than those in Office A.

Formula 3, however, is not quite correct, because the rate of gross profit from non-profit premiums cannot be as great per premium as from with-profit business, because with-profit premiums have an extra margin or "loading" to partly provide for Bonuses. The true loading on a non-profit premium is not the difference between the office rate and the net premium usually used for valuation purposes, but generally consists of a lesser percentage, namely, the difference between the office premium and a net premium, based on the mortality from non-profit policies only, in which the effect of recent medical examinations is allowed for, or what is technically called a "Select" Table, deduced from the experience of offices under non-profit policies. Bearing this in mind, and also the fact that in spite of the results of the recent investigation of the British offices, there has been a tendency to reduce non-profit premiums, the total margin on a profit premium may be taken as bearing the same relation to the total margin on a non-profit premium as 3 to 1. In this manner,

$$\left(\begin{matrix}\text{The total loading}\\ \text{on A's premium}\end{matrix}\right) : \left(\begin{matrix}\text{The total loading}\\ \text{on B's premium}\end{matrix}\right) :: (95\times3+5\times1)$$
$$: (72\times3+28\times1) \quad . \quad . \quad . \quad (4)$$

and as the profit from the various policies may be taken as being roughly proportionate to their true "loading," then combining formulas 3 and 4, we get

$$\text{Acb} : \text{Bcb} :: \frac{1}{95}(95\times3+5\times1) : \frac{1}{72}(72\times3+28\times1)$$

$$\text{or} \quad :: \left(3+\frac{5}{95}\right) \quad : \left(3+\frac{28}{72}\right) \quad . \quad . \quad (5).$$

If, however, the margin on a non-Profit Policy be considered as one-half of the margin on a with-profit policy, the formula becomes—

$$\text{Acb} : \text{Bcb} :: \left(2+\frac{5}{95}\right) : \left(2+\frac{28}{72}\right) \quad . \quad . \quad . \quad (5a.)$$

To enable this formula to be worked out with more accuracy, the following table has been constructed :—

TABLE XI.

LOADING OR MARGIN IN AVERAGE OFFICE PREMIUMS FOR £100.

Class.	Age at entry.	Office Premiums taken at	Select Net Premiums at $3\frac{1}{2}$ per cent.	Loading on $3\frac{1}{2}$ per cent. basis. Amount.	Loading on $3\frac{1}{2}$ per cent. basis. Rate on Office Premium.
			$O^{[m]}$		
Whole Life with Profits.	25	2·157	1·444	·713	33·055
	35	2·791	1·959	·832	29·810
	45	3·807	2·806	1·001	26·294
			$O^{[nm]}$		
Whole Life without Profits.	25	1·807	1·551	·256	14·167
	35	2·362	2·093	·269	11·389
	45	3·310	2·997	·313	9·456
			$O^{[m]}$ at $3\frac{3}{4}$* per cent.		
Endowment Assurance with Profits.	25 at 55	3·259	2·278	·981	30·101
	35 at 60	4·141	2·998	1·143	27·602

* The Endowment Assurance Net Premiums are taken at a higher rate of interest, on account of the lighter mortality under Endowment Assurances.

Now, combining all the formulæ in connection with the comparison of Office A with Office B, we get

$$\text{Acb} : \text{Bcb} :: 89 \times 9 \times \left(3 + \frac{5}{95}\right) : 90 \times 8 \times \left(3 + \frac{28}{72}\right)$$

$$\text{or} \quad :: \quad 2445 \quad : \quad 2440$$

so that there is little to choose between the two hypothetical offices under consideration.

Fourth Test. A fourth test is to consider which of the two offices is likely to afford the policy-holder the most "Profit from Interest."

What is called "Profit from Interest" is really the difference between the interest actually earned on the Reserves during a quinquennium, or other valuation period, and the interest which it was assumed would be earned on such Reserves, when the liability was estimated under the policies in force at a previous investigation. All offices invariably make a "Profit from Interest," as no Actuary, worthy of the name, would discount future liability at a rate of interest as high as that obtained by the office on the Funds invested. Offices, however, which are of recent date, or which have a large number of comparatively new policies on their books, cannot make such a large Profit from Interest, relatively to their premium income, as an old-established office with many policies which have long been in force, and which have thereby acquired large reserve values.

It is a common practice of some critics, when comparing the strength of offices, which is invariably laughed at by Actuaries, to take "the number of premiums in hand" as a basis of comparison. The fallacy of such a comparison is obvious, when one remembers that an old office which has, say, ten years' premiums in hand might really require to have those for eleven years, while a younger office might have three full years' premiums in hand, and, if a most stringent valuation were made, two years' premiums might be found sufficient. On the other hand, as far as profit from interest is concerned, there is no doubt that, all other things being equal, the office with most premiums in hand is in far the best position.

In some of the older offices as much as half their total profits are made out of surplus interest. It is impossible, however, to make exact comparisons between the bonus-earning powers of offices in this connection, as the younger offices, or the offices

with many recent policies often make a considerable, though artificial, profit from selection, although their reserves are small per policy, and thereby can yield little profit from interest. Again, as already mentioned, it costs little to allot to new policies, which are generally on young lives, Reversionary Bonuses of considerable amount, so that what is, in a sense, the very weakness of young offices (or offices doing a large amount of new business) can be a cause of apparent prosperity. It is, therefore, advisable for anyone, other than a highly skilled expert, to apply the three first tests only.

Second Test and Mutual Offices. With regard to the second test, it is interesting to consider how much the Mutual principle is worth, reckoned as a percentage on premiums. First-class offices have a divisible surplus which varies from about 30 to 50 per cent. of the participating premium income, and, as seldom less than one-tenth, and seldom more than one-fifth, of a Life Company's profits are paid to shareholders, the saving in a Mutual office varies from about one-tenth of 30 per cent. to one-fifth of 50 per cent.; that is, in a good Mutual office, as compared with a good Proprietary office, the Mutual principal is worth from *three* to *ten* per cent. of the premiums paid by the Mutual policy-holder. Where, however, in a Proprietary Company the surplus includes interest on shareholders' paid-up Capital or Reserve Funds, a modification of this theory must be considered. Of course, if the Mutual Society is insolvent, the Mutual principal is worth nothing, but this is a contingency which need seldom be considered.

Value of Non-Profit Business. With regard to the third test, it is possible for an office to do a "profit" business only, and to issue no non-profit policies; on the other hand, it is quite possible in an office with a good legal connection to receive a premium income, half of which is from non-profit policies; and, working on formula (5), the limits of value appear to be from $(3+\frac{1}{2})$ to 3, or from 7 to 6, or, say, 100 to 86 per cent. of the participating premiums, and one might argue that it would be possible for an office doing a large amount of non-profit business to, as it were, score 14 points per cent. of premium against another office doing none.

One may remark, in this connection, that the profits to be made in Loan business appear to be less than formerly. Competition is so great among offices that if, say, a landed proprietor wishes

to get a loan on his estates, if his solicitor knows where to go, and, if the borrower is willing to throw in as collateral security a *new* policy on his life, though the principal security offered consists to a large extent of English arable land, Scottish grouse moors, or even Irish crofts, not only will he probably get a larger loan than the security merits, but he may be let off with a rate of interest little above, possibly below, the rate on which the Actuary of the office bases the valuations.

With regard to large loans connected with reversions, there is no doubt that much profit has been made in the past in these transactions, and by a liberal arrangement of re-assurances I believe it is possible to make a profit whether the reversioner dies early or outlives the life tenant. This method of trading, however, is hardly to be commended.

With regard to commercial insurance, such as where the lives of partners are insured in connection with some business transaction, or where, if money is lent on an industrial concern, the lives of the youngest or other partners are insured as collateral security under, say, a ten or fifteen year Endowment Assurance policy, with care good business can be done, provided the office has its headquarters in London, or if the Head Office be not in London, if the Company has a very competent staff in the London office. Loan transactions on personal security, coupled with insurance policies, preferably Endowment Assurance policies for short periods, are also very good, provided the management is in a position to find out all about the guarantors, or the directors in the course of their own business have come to know about them.

Some managers and their directors have sentimental objections to transacting personal loan and reversionary business, and some object to such business on account of the additional amount of trouble involved. And probably this is the reason why Reversionary Companies have been able to usurp the legitimate functions of Insurance offices and gather in profits which should never have been allowed to go past their policy-holders.

The mere accumulation of premiums paid by, no doubt, first-class lives under provident policies is certainly the very best method of helping the public to provide for the future. But the work is rather too much like that of the Savings Banks, and is not always the best way of collecting surplus to provide for Bonuses, and it is undoubtedly not the most likely way of making profits for shareholders.

Mutual offices, as a rule, do not do much non-profit business either in connection with Loans or in connection with commercial transactions, but there is no reason, of course, why they should not.

Application of the Tests. The first test can be used most effectively to show that British offices ought to be able to give better terms than either American or Colonial Companies.

The second test is a useful weapon in the hands of those representing Mutual Societies.

The third test can be applied with advantage by the representatives of Companies doing a large loan or reversionary business.

The fourth test should put old-established offices in a favourable light.

The third and fourth tests, however, are somewhat too difficult in their application to be of much use to canvassers.

REASSURANCES.

One very important duty among those engaged in Life Assurance Trading is the arrangement of Reassurances. When offering a reassurance, the principal office should always give very full information to the reassuring office; nothing detrimental to the life, however trivial, should on any account be kept back. Not only is the withholding of such information a very questionable act, but it is also a stupid act, and, generally speaking, bad policy. If the officials of the reassuring office, rightly or wrongly, come to the conclusion that the principal office has been trying to take advantage of them, not only will they refuse to take further cases from the principal office, but, what will be worse for the principal office, they will not reciprocate with other business. Even if a life has an unfortunate medical or personal history, there is no objection to the principal office clearly saying so, for, provided only that they take a line themselves—(and unless they do so, or have already done so, they must not offer a reassurance)—in these hard times, they will always find some other office willing to follow them.

There is among Life Assurance men, particularly among some Scotsmen, a feeling that the class of life which is involved in large loan transactions, and is usually the class to be reinsured, or even ordinary lives which are reinsured, are not such safe risks as

policy-holders who complete for smaller sums. It must be borne in mind, however, that too much precaution in reassurance business very often defeats its own object. If a manager is in the habit of worrying for what may appear to the other office unnecessary details, or if, on account of the rules of his office, or for other reasons, he is not in a position to give an early acceptance, his friends will hesitate to put before him the first offer of their best cases, and, instead of getting the choice of the best that is going, he will only obtain proposals of cases which have been refused previously by other offices.

With regard to immediate powers of acceptance, one or two managers in London have undoubtedly in the past obtained thousands of pounds of reassurance business, merely because they were able to say "yes" or "no" on first seeing the papers. For though all proposals for Life Assurance should be expeditiously dealt with, there is invariably a special hurry about good reassurance business, and it very often happens that first-class offices lose the offer of good business because the Actuary is not in a position to give an immediate acceptance, but has to wait two or three days until he can submit the papers formally to his Board.

The best class of policies which require to be reinsured are those effected by rich men for provident purposes. When such men think of insuring, they invariably make inquiries of one or two offices, and, if there is any delay, there is a possibility that the proposer may change his mind and not insure at all, or may be talked over by the representatives of some other office, or, most annoying of all, the agent or interested friend who introduces the case may be bought up by an unscrupulous rival.

For these reasons there is seldom time for English Companies to place *good* reassurance cases outside the four mile radius.

With regard to the reassurances of lives where the papers are not quite clear, I think that within reasonable limits an Actuary is justified in treating the undoubted saving of expense in such cases, as compared with proposals secured in the usual way, as an addition to the premiums. This saving really amounts to £2 or £3 down and about 4 per cent. on all renewals, and these sums, if considered as loading, can go a long way towards converting an insufficient into an ample premium.

This theory, that money saved in expenses can be considered as going to strengthen otherwise insufficient premiums, is, of course, not confined to re-insurance transactions, but it is a very dan-

gerous theory, and must only be applied in practice with the greatest caution.

IN CONCLUSION.

In conclusion, I think it right to state that the remarks as regards expenses, and especially the tables, are not intended to be final, but are meant to indicate a method of blending scientific accounting with actuarial science. And although there has been a good deal of labour in collecting the figures and in preparing the tables, the work is undoubtedly somewhat crude and made up of many averages. Still I hope that further and better work may yet be done in similar directions, with a view to our studying and getting the better of the many difficulties which occur in Life Assurance Trading.

I cannot expect that all my statements in connection with office practice will meet with universal approval, but I have tried throughout to give no unfair advantage to any particular class of Companies, and I trust that those who may think that some of my opinions are wrong will understand that they are given in all good faith.

I take this opportunity of acknowledging the much appreciated counsel and skilled assistance which I from time to time obtained from Mr. Stenhouse, Mr. M'Kean, and Dr. Buchanan. I also feel indebted to Mr. S. F. M. Cumming, who helped me to construct the tables.

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PROPOSAL, MEDICAL, AND OTHER FORMS IN CONNECTION WITH LIFE ASSURANCE.

By JOHN RODGER.

A Paper read before the Nottingham Insurance Institute on April 7, 1905.

A CONSIDERATION of the Proposal, Medical, and other Forms in use in the business of Life Assurance covers a rather wide area, and brings a varied and large number of matters within our purview; some of these I should like, as far as I may be able, to present for our mutual instruction. We must look successively at the uses of the forms, the varying practice of Offices in respect to them; the reasons for and exceptions permissible in their use; the procedure as to proposals; the importance of adherence to rules, which are the outcome of careful study; the tendency to break rules, and so on. That forms of widely differing character are in use by the Assurance Offices operating in this country is known to you all; these are the product of many minds, and to some extent of different periods. In their construction the object aimed at, viz., the eliciting of complete facts, has been approached from different points of view. Criticism might readily be passed in some instances on questions found embodied in the forms used, but criticism is not the object to be kept before us. An honoured conservatism appears largely to influence the actions of Life Assurance Companies, and explains the adherence to forms which in many instances have done duty with little or no alteration for fifty years or more. The forms most frequently in use, which I wish to consider separately, are:—

(1) The Proposal.
(2) Medical Report Form.
(3) Medical Attendant's Report Form.
(4) Private Friends' Report Form.
(5) Agent's Report Form.

Other forms less frequently in use but calling for notice are:—

Supplementary Medical Report Forms on special ailments (as ear and heart troubles), also on special features (as consumptive history, excessive corpulence, &c.).

Declarations as to Interest in an Assurance effected on another life, also as to age, &c.

Notices of Acceptance and Declinature.

Passing over the detailed procedure in carrying through a proposal for life assurance from its inception to completion, I shall go on to the separate forms, but would refer momentarily here to the occurrence of an illness to a proposer subsequent to the examination and before first premium had been paid. In cases of such an illness, even where it is of a slight nature, the safety of both the proposer and the Company demand that its nature should be communicated to the latter before the premium is accepted. The acceptance notice invariably draws attention to the fact that such an illness, unless intimated, would invalidate the assurance proposed to be effected.

For convenience, I speak of the proposer throughout the paper as "he" and "him," though in general the remarks may apply equally to a female proposer.

The Proposal Form.

It may perhaps be said truthfully that the proposal form receives far less attention than its importance deserves. It is the basis of the contract to be made. A contract implies good faith on the part of both parties to it, also accuracy as to statements made. The Company is precise in its statements and promises; these are elaborated with precision in the prospectus which it necessarily publishes, and which forms part of its policy contract. There is not the same means of securing accuracy and definiteness of statement on the proposer's side, but he signs a declaration at the foot of his proposal which vouches for the correctness and truth of all the statements he has made or will make. It is sometimes objected by the insuring public that Insurance Companies are much too particular in their enquiries, but these objectors see only the commercial side of the transaction and probably nothing of the judicial, hence their thinking Offices exacting. The proposal form is, perhaps, more frequently than otherwise not seen by a proposer prior to his filling it in, or to his dictation of the replies to be filled; he thus in many cases lacks the opportunity for weigh-

ing in his mind and appreciating the full importance of the questions he is answering. I have a strong conviction that the full importance attaching to the proper filling-in of a proposal form is not appreciated by Insurance agents and by many officials as it ought to be. It is often enough not realised at all that, in order to make the insurance sought a real protection to the would-be assured, a just and truthful account of his history is called for. Whatever the temptation be to do business, the agent or official should be most careful to give no gloss to statements in a proposal which might alter their meaning, nor to generalise references to unpromising facts or illnesses in a proposer's history in the hope of obtaining a favourable decision; in filling up a proposal he is generally regarded as the agent of the proposer in the eyes of the law, and renders him bad service indeed if he conceals or improperly states incidents which may be supposed to affect the decision.

The proposal form, after recording the intending insurer's full name, occupation, and address, and place and date of his birth, usually contains questions calling for a short statement of illnesses he may have had, the name of his ordinary medical attendant, and of any medical men who may have attended him otherwise; the names of Offices to which he has previously proposed or to which he may be proposing, with the results of these proposals in the former case, also as to whether he has ever been rejected by any office. A variation of this last question is occasionally met with—"Have you ever been medically examined for insurance?" This question in some instances appears also in medical report forms. The names of either one or two referees are required, and, after recording the class of policy and amount of assurance wished, the proposal concludes with the "Declaration" already spoken of. In a number of instances the form of proposal elicits particulars of the family history, in the form of a tabular statement showing ages, if alive or at time of death, of parents, brothers, and sisters, and noting those who may have died, with causes of death. In other instances Offices regard the eliciting of these family history points as coming within the province of the medical examiner, and there is much to be said for this view; but where, as so frequently is the case, Offices have to deal with proposers of varying intelligence, it is more convenient, perhaps, to have family history points brought out prior to a proposer's interview with the examiner. The examiner would, as a rule, be best qualified to get an

intelligent statement of the family history points, though the wide range of medical men necessarily employed and the infrequency of examinations made by each of these would modify the advantage possessed by the medical man over the agent in respect to filling in such history. Again, if the family history be very bad and the life young, an Office may feel that the result would not be affected by an examination, and would therefore properly save the expense. By whomsoever particulars of family history with the various causes of deaths are obtained, it is important that vague replies and indefinite causes of death be investigated as fully as possible in order to provide the Company's officials with information necessary to a decision. Causes often supplied, such as "childbirth," "dropsy," "a severe cold," "inflammation," and so on, are indefinite and of little practical value. It too frequently happens that "childbirth" and "a severe cold" prove to have been phthisis. On the other hand, if it is known that a person deceased had been very intemperate before death, that information, often concealed from mistaken motives, may be of value to the Office. It is sometimes questioned whether Offices are justly entitled to ask for such precise information as to past proposals, and especially as to any contemporary proposal; it may be suggested that in fairness they ought to arrive at their decision without seeking the means of conferring with other Offices who may have the life under review, so possibly helping to prejudice these other Offices against proposer. Against this line of argument it must be borne in mind that a proposer may have some intuition guiding him in seeking an insurance, while the Office can only get a superficial view of facts and must run all risks on points which it cannot penetrate, so that it is fairly entitled to have all the means which can be placed at its disposal for forming a correct opinion, also that it is hardly likely, in its own interests, to make unnecessary demands on proposers for information.

Going back somewhat to the questions found in the proposal form and to the declaration, we meet, naturally, with some variety in these. In some forms the question is asked "Is proposer strictly temperate?" or "Is proposer an abstainer and, if so, since when?" These questions occasionally appear in the medical report. The value of the question "Is proposer strictly temperate in habits?" may be open to much doubt, unless in its legal sense, in relation to the declaration. If the question be asked "Is he an abstainer?" the corollary "How long has he been so?" is obviously

necessary. Recent total abstinence would suggest personal reasons which might greatly influence the Office in accepting or refusing. It is hardly necessary to say that this question of temperance is one on which all Offices without exception place great emphasis. A careful examination of the claim lists would show with how much reason.

In the matter of a proposer's medical attendant, or the name of any doctor he may have consulted, it seems to me that no question can be readily framed to cover every point. A man may have no medical attendant and yet have often had attendance, on each occasion from a different medical man; to ask a list of all the medical men a proposer may have sought advice from during an average lifetime would be irksome and tedious, so that the very frequent form of question "What medical men have you consulted during the past five years, and for what ailments?" appears to best meet the difficulty. A useful form of question occasionally met with is "When did you last consult a medical man, and for what?" In leaving this point, I imagine the request for the name of a proposer's medical attendant to be a time-honoured one which was more applicable to the customs prevailing and to the more settled habits of people fifty years ago than to these days.

In some forms the rather startling question is found "Has proposer ever suffered from insanity?" As forming part of the proposal it seems unpleasantly personal. The suggestion naturally arises "can a man who has really had some temporary abberation of mind be expected to recognise this himself?" By a gentle reference to "mental ailments" rather than the blunt question "Have you been at any time insane?" more would probably be elicited, but this question seems rather in its proper place in the medical examiner's report.

The very usual question "Has any near relative died from consumption, insanity, &c.?" leaves room for doubt as to what is a near relative. This difficulty disappears where, as in some proposals, the question is, "Has any relative, as parent, brother or sister, or uncle or aunt, died from consumption, &c." In the same way the diseases or illnesses which would properly be regarded as "hereditary" do not occur readily to every mind. The following detailed question in the medical form of one Office meets this difficulty adequately: "Have any of your near relatives suffered from consumption, cancer, rheumatism, gout, asthma, fits, apoplexy, insanity, or other disease transmitted by hereditary

descent?" The question often found still in the proposal "Are you likely to go abroad?" smacks of the bygone times when a voyage abroad meant risk by sea and land in the adventure. It is curious to note how the oldest questions cling to the present-day proposal form, and certainly some forms place an undue emphasis on questions relating to foreign travel and residence. In cases where the issue of a world-wide permission to travel depends conversely on the likelihood of the applicant's need of it, the relevancy of the questions is apparent. A question of some importance is occasionally met with—"Do you intend following any other occupation?" This would have an important bearing on the acceptance in certain cases, as for instance where some illness which a proposer has suffered from might be of little moment if the occupation were, say, bank manager or lace manufacturer, but if these occupations were to become mining engineer or journalist the new occupation would have a totally different bearing on the illness.

On the important matter of the declaration alone a paper might be written. I can only touch the fringe of the subject. The usual form of declaration vouches that all questions contained in the proposal as well as those to be put by the medical examiner are answered truly, and proposer agrees that those answers shall form part of the contract to be made—shall be, as is usually recited, "the basis of the contract," &c.

Forms of declaration are in some instances very binding in their terms, appearing almost to provide loopholes for possible dispute. These binding stipulations as to the absolute accuracy of all statements made by a proposer become of more importance when met with in conjunction with a proposal form which, as in one instance, asks not only whether the proposer has ever suffered from a long string of detailed illnesses, but whether he has ever had *any symptoms* of these illnesses. It might be difficult to avoid falling quite unconsciously into a possible misstatement. How is the ordinary lay mind to recognise that its owner has had symptoms of an illness which could perhaps only be recognised by an expert medical man? If a subsequent early death should prove to have arisen from an ailment whose symptoms some years beforehand are ordinarily recognisable, would the claim be invalidated? A strict interpretation of the language of some declarations would make it appear so. Occasionally the declaration requires proposer to state that he is in good health, that he

suffers from no disease or habit tending to shorten life, and all these statements become the basis of the contract. It is not usual to include the question of correct age in the declaration, but in some few instances this also is made a condition of the validity of the insurance granted. On the question of health I think the utmost a proposer should be committed to in his declaration would be the statement that he believes himself to be in good health. As to the point of correct age, an Office might well dispense with the right to invalidate the insurance and to retain all premiums paid should the age given prove incorrect. The binding declaration seems a survival of an early belief that it was necessary for an Office to hedge itself about with every possible precaution and safeguard against the depredations of a designing public. One of the most concise forms of declaration in use simply declares the statements made to be true, declares also that the referees named are persons competent to give information as to habits and past health, and agrees that the statements in the proposal, together with those to be made to the medical examiner, shall form the basis of the contract. This is certainly a liberal departure from the more common form.

The whole question of the declaration is affected by the particular Company's rules as to making policies indisputable, and at most it is during the early years of an assurance that the terms of the warrant are of critical importance. Public opinion would hardly tolerate an opening up of the points minutely involved in a declaration where death took place after many years. Again, after the lapse of years, information enabling an Office to dispute the correctness of a declaration would not so readily be obtained.

With this very imperfect study of the form of declaration we must pass on.

In a few instances the proposal, instead of being drawn up in schedule form, is rather in the nature of a deed or declaration beginning with the personal pronoun "I" and reciting in general language a few salient features relevant.

The tendency in newer proposal forms seems to be towards the elimination of questions bearing on specific illnesses, leaving these and family history matters to be dealt with under the guidance of the medical examiner. In general, the newer forms, both medical and proposal, show a definite conciseness, and this applies also to the forms of declaration at foot of the proposal, some later forms

adopted not exceeding one-third the length of forms still commonly met with.

Where an assurance is effected by one person on another's life separate forms of proposal are often used, and in such cases a separate form of declaration may be called for, the life to be insured merely declaring the correctness of his statement as to personal and family health and the person effecting the insurance agreeing to the Company's regulations and accepting the statements by the life proposed as part of the contract; he will also be called upon to declare in the proposal or under a separate instrument the extent of his financial interest in the life to be assured, or to state that the sum of the policy does not exceed his interest in the life. As one cannot legally effect insurance beyond the extent of any financial interest in another life, Offices are usually very careful to satisfy themselves that the insurance to be created has a reasonable relation to the probable amount of the interest; and as an Office may not afterwards cut down the benefits under a policy to meet a diminished or extinct financial interest in a life which has been so insured, the greater care is necessary in accepting.

In a few instances several varieties of proposal form are in use to meet specific cases, *e.g.*,

1. Forms for "own life."
2. " " " for benefit of wife and children.
3. " " " for an Endowment assurance.
4. " " insurance on life of another.
5. " " joint lives.

Separate forms of proposal for children's Deferred insurances, child's Endowment policies, pure Endowment policies, Annuity contracts, and so on, are, of course, generally met with.

The Medical Form.

With the medical forms in use by Offices we are naturally not so familiar as with the forms of proposal, and very great diversity is found in the construction of the former, which, in the first instance, are probably prepared by a medical board or medical consultants, and from many different standpoints.

No set of questions, however skilfully framed, will enable an examiner in every instance to defeat the one steady purpose of some proposers, viz., evasion, but judgment and skill on the examiner's part will often help materially in this.

The "sense of proportion" observed in the character of questions

asked is not always apparent; many anomalies are presented, but different methods of attaining the desired end are perhaps to be looked for.

In a few isolated instances no prescribed form of questions is set for the guidance of the examiner; he is either presented with a perfectly blank sheet on which to send in his report on the life (in one instance this blank sheet having less than the surface space of half a sheet of ordinary letter paper), or, at most, has his attention drawn in a covering letter to the points to which special notice should be directed. The value of this discretionary power given to the examiner would be evident chiefly where he frequently reported to an Office. In some instances a *resumé* of the principal replies of a proposer in his proposal form prefaces the medical questions. The usual plan followed is to divide the medical statement into two portions, (1) questions put personally by medical examiner to proposer with his replies thereto, and (2) the report of the examiner on proposer's physical condition and his recommendation as to acceptance; to his replies proposer is usually required to append his signature in the presence of examiner. The signature, though it may reveal traces of nervousness, serves as a means of identification in any possible attempt by a healthy life to personate one not so robust. In this country attempts are rarely made to substitute a healthy for an unhealthy life, and it would be difficult to carry out the imposture successfully. It is probable that an attempt of this kind would have but doubtful chance of success from no other fact than that the part would be apt to be overdone.

The questions set to be asked by the examiner usually elicit with more detail than in the proposal the illnesses a proposer may have experienced during his life, the list being arranged in a series of five or six well-known groups—as lung troubles, heart complaints, irregularities of the digestive organs and illnesses arising therefrom, illnesses of the uric acid order (gout, rheumatism, &c.), nervous affections, and accidents. A chance indication arising out of the replies will naturally guide the examiner in the physical examination. A further question is frequently put respecting hereditary ailments among relatives. The medical examiner must satisfy himself as to the condition of the lungs, heart, pulse, liver, and kidneys, and of the ears. He will note the aspect of proposer as to build and temperament; state his height and weight, and note any inconsistency in these or as to

the weight in relation to proposer's age; he will touch on other minor points that occur to an experienced medical man as having a bearing on the question of longevity or the continuance of health. He must note the appearance as to temperance, past and present, and elicit any unfavourable history. It is important he should look at the symptoms, if any, of nervous disorder, and indicate any probable tendency to or reason for an early break-down. He completes the examination by getting proposer to pass a specimen of urine to be afterwards chemically tested. A short digression here with respect to the urine test in cases of ladies' proposals may be useful. In a few, but a minute proportion of instances relatively, the examiner has discretion to dispense with the urine test where ladies are concerned; in only one instance that I have noticed has the examiner instructions not to require the specimen of urine from female lives. The existence of and justification for the usual female extra centres in the fact that with female lives the same strict examination that is possible with male lives is impracticable, though the examiner must discover as far as may be by judicious questions the past health of the lady on points which might involve break-down afterwards. The examiner finally sums up the report and classifies the life. To the question of "temperament" it seems to me Offices generally might more pointedly direct the attention of their medical officers. Under present-day conditions of life there is probably more reason than formerly was the case to take into account any suspected morbid tendency in a proposer. The greater strain in the conduct of business increases the frequency of nerve troubles which, though not fatal in the first instance, do undoubtedly lead to developments which shorten life. In one Company's medical report form the examiner is asked whether the appearance of proposer suggests cheerfulness. Coming from a skilful examiner of some experience an opinion as to any apparent gloominess of disposition must obviously be helpful. With respect to the possible eventuality of suicide, I need only remark that while Life Insurance would most rarely be effected with any motive of this kind in view, still, in view of the liberal suicide clause of many Companies, it becomes necessary to guard as effectually as possible against the admission of a suspicious case.

Questions of an unusual kind are occasionally found in medical reports, such as "Have you suffered from any accident or injury,

or used any powerful or active remedies?" "Have you had dropsy of any kind?" "Has applicant ever had vomiting?" "Is he married? if so, has he any children?" Other trifling eccentricities might be specified were it not inconsistent with the serious character of this paper. Curious groupings of ailments also arrest attention occasionally.

One is inclined to wonder what may be the exact object in view in asking a proposer such a question as "Do you consider yourself free from disease and of a good constitution?" Most proposers do so rightly or wrongly. I think the individual who does so, even without justification, is hardly to be blamed.

In most report forms emphasis is put on questions of present and past habits of a proposer, in a number of instances specific information being asked as to the quantity of stimulant consumed per diem. It may be doubted whether statements on this head are of much value, beyond the clue which answers given may afford the examiner in estimating the type of proposer before him. It is noticeable that the questions in medical reports, and more frequently so in the proposal form, are framed to some extent from the point of view of the social class among whom business is usually transacted. The value of answers given by proposers both as to family record and as to past personal ailments is greater where the social class is good. In the question "Have any near relatives died from or been affected with consumption, insanity, &c.?" some Offices specially include gout, and some epilepsy and asthma; perhaps here again the distinction of social class is apparent in the ailments specially alluded to. One Office pertinently asks "Is any relative now suffering from consumption?" In their medical form a few Offices obviously guard themselves by asking a specific statement as to every ailment to which flesh seems heir, and then follow this up by requiring a declaration vouching for the correctness of every detail! In one instance proposer is made to add that he consents to the Office making enquiries of any medical man who has attended or who shall attend him.

In only one instance have I seen the query put to the examiner in a medical report, "Are you related to the proposer?" It is a point of some importance that a proposer should not be examined in the presence of a third person, least of all of the agent; in a few instances the medical examiner is asked "Were you alone with the proposer during examination?" The wisdom

of having the medical examiner's report transmitted direct from examiner to the Company's salaried representative will be readily apparent, and though not the invariable rule this is very generally required. Harm results rather than any benefit where the practice is to allow the ordinary agent to receive an examiner's report, this harm not necessarily from any breach of confidence on the part of an agent, but from possible misconception arising out of medical language, the bearing of which he may not understand. The last point that might be mentioned is the importance of impressing upon medical men that it is in every way against the interest of the Office, which it must be remembered they are paid to serve, that the result of the examination should be discussed with or even communicated to the proposer. Something is to be said, perhaps, for the nervous proposer who, it may be, is somewhat disturbed, and would like to be reassured that all s right. An examiner of tact will be able to convey a reassuring word, and yet not commit himself to anything approaching a disclosure. I have personally known instances where the abrupt refusal of an examiner to reassure a proposer in any way, even when no reason for suspecting an unfavourable symptom existed, has caused the proposer to go off in fancied alarm to an independent medical man, with results unfavourable to the Office. It is the practice of a few Offices to require proposer to see two of their medical referees—generally at a joint examination—in cases where the proposal is for a sum of £5000 or upward.

Life Assurance without Medical Examination.

Life Assurance without medical examination, in various forms and chiefly during recent years, has come into use to some extent in this country. In what may now be termed the "experimental" stage its use was restricted first to a form of Double Endowment assurance, now well understood and in common use both with and without medical examination. To meet the difficulty of non-examination a specially stringent form of proposal is generally used, this in some cases embodying more or less the salient features of questions usually found in the medical examiner's report form.

Policies issued without medical examination usually become effective as regards the assurance part of the contract either gradually or after a short interval of time, unless death should result from accident, when the full sum would become payable,

and it is stipulated that no assignation of the assurance can be held valid either until the assurance is fully effective or until twelve months after that event.

The application of the non-examination principle has become extended in a few instances to ordinary forms of Whole Life and Endowment assurance with the safeguards already spoken of. A later form is the Monthly Premium plans of one or two Offices. In these medical examination is optional, and if adopted the assurance becomes effective at once; when a non-examination proposal is made a slightly fuller set of questions is answered, the assurance becoming gradually effective as before. In keeping, presumably, with the prominent aim of simplicity in form, the medical report used in connection with monthly premium assurances is usually simpler and shorter than the ordinary one.

Medical Attendant's Report.

We must now look at the construction and uses of the medical attendant's report form, which is one not made use of by all Offices. I refer to it here because though much out of use it still has a place in orthodox practice. A quarter of a century ago, when Life Assurance could claim less popularity than it does to-day, the use of the form was much more customary. Then policies were effected more guardedly on both sides. The Office, with fewer applicants, took greater pains over details, while at that period, also, ancient customs had not, perhaps, to any great extent broken down. I do not suggest that it was common in respect to all or most proposals to refer to an applicant's medical attendant, but where he had suffered from any serious illness it probably was done by all the best Offices. Medical science was less accurate, clear definitions of an ailment were less commonly given to a patient, and the patient also then placed himself more unreservedly in the hands of one medical man, so that these various reasons made reference to the medical attendant of greater value to an Office. The use of the form is retained chiefly in cases involving special difficulty and by some Companies in all cases of large amount, say where this exceeds £2000. This partial disappearance of the form has been gradual, Offices, probably, in some cases being satisfied that it added little to the real information obtained. In the construction of this form there is not the same room for variety as in those we have already considered. The questions set down to be answered by a proposer's medical attendant are usually limited to ten or twelve, dealing chiefly with

the principal divisions of ailments for which one may have consulted him ; one of the questions being usually of an omnibus nature—" Have you attended him at any time for any other illness or trouble ? " A final question, such as the following, very often appears—" Is there any circumstance or information within your knowledge likely to affect the health or longevity of the proposer for insurance which ought to be communicated ? " In some instances the medical attendant's form specifies a list of ailments or symptoms of a most comprehensive kind.

The form of covering letter addressed to the attendant to be found on the front of this form is little altered from that of very early days. In many cases the phraseology used is somewhat incorrect, seeing it recites that " A.B., who proposes for Life Assurance, having referred to you for information respecting his present and general health," &c. At the present day very few proposers would look for a reference, under ordinary circumstances, to the attendant in a past illness. A more correct covering letter is in use by some offices, " A.B., a proposer, having mentioned your name as his medical attendant, the directors beg to ask for information on the points enumerated," &c. Occasionally the covering letter on front of this form and that on the friends reference form are in identical terms, excepting that in the former case the remark is added " A fee will be paid on receipt of report." The similarity also extends, in some cases, even to the form of the sheet and number of questions, suggesting, one may be pardoned for thinking, some poverty of thought in their original construction. In one or two instances no printed covering letter is in use, a letter explaining the precise reason for the report being presumably sent with the Company's form.

One of the objects of the medical attendant's form must be to gain a knowledge of any illnesses which a proposer may, inadvertently or otherwise, have omitted to mention in any way, and if information respecting a serious illness not otherwise indicated be forthcoming, it may become a question whether the proposal should be declined on the ground of other possible concealment which would prove detrimental to the Office. One Office in its form asks whether the attendant knows of the proposer's having consulted any other medical man within the previous ten years. A most useful question where this report is sought is one occasionally met with—" Have you had occasion at any time to test A.B.'s urine and with what result ? " There is no finality in the urine test; it

may prove satisfactory at the time a proposal is made, while the proposer, without knowing it, might have had some irregularity which at another time would have been a barrier to insurance. It may be noted that where the regular use of a medical attendant's report is more or less common the form is often of a comprehensive nature; its use also is more frequent with Offices transacting the best class of business socially, in which a reference to a medical attendant would be of practical value from the fact that the proposer would generally have a regular attendant and from the higher intelligence he naturally would have in supplying information. It is also in such Offices that wider latitude is allowed to the medical examiner as to the character of the examination made.

Friends' Reference Forms.

Different opinions are probably held as to the practical value to the Office of the time-honoured institution of Private Friends' reports which, to some extent at least, have probably outlived their usefulness. With greatly advanced medical skill and a better knowledge amongst examiners as to the spirit in which they are expected to report upon lives, and in view also of modern considerations generally, the need for these is in some respects lessened, and it may become a question whether they are really indispensable. If we consider how much easier it would have been fifty years ago for an agent, a proposer of indifferent health, and a medical man with easy sense of duty, to combine, consciously or unconsciously, to get doubtful business accepted, we can at least see greater utility then in the friends' references. These forms too often, we fear, contain rather varnished replies regarding proposers, though in respect of the glimmer of truth occasionally present they have a value to the Office. It may be partly owing to a belief that the public would not evince much special interest in the Office abolishing this form that its use is still customary. So far, no Office to my knowledge has had the courage to discard the use of friends' reference forms. It probably also remains a requirement partly from the feeling that the use of the form leads to extended business, and this possibly is so, though to a greatly decreasing extent. Its value to-day as a means to the agent of initiating business relations is greatly lessened. There will always occur very occasional cases—not more perhaps than one in each hundred—where an answer by one of these referees will put the Office on its guard on some point not brought out

otherwise; but in general my feeling is that the utility of the reference forms centres on the one question "Are his habits and mode of living regular and temperate?" If this be the all-important question in a private friend's report, an absence of stereotyped form in the wording of the question is an essential point, the stereotyped question "Is proposer regular and temperate in his habits?" tending to produce an equally stereotyped "Yes" in reply. The other questions, put in varying language by different Offices, may, for any practical purpose they serve, be regarded almost as "padding." In this age it has to be remembered that one's friends may know very little of one's earlier habits and nothing at all of one's relatives. The habit of moving about in search of richer pastures tends in a great many cases, of young lives especially, to leave one with friends of at most a few years' standing only. If these new friends know nothing to our detriment they very naturally assume the earlier years of life to have been as satisfactory as they know later ones to have been.

The questions usually found in the Private Friends' reference form, from ten to a dozen in number as a rule, deal with the following points:—

(*a*) Length of acquaintance and degree of intimacy.

(*b*) As to the general state of the proposer's health during acquaintance.

(*c*) As to any definite or serious illness of the proposer which the friend can recollect.

(*d*) As to the healthiness of his family connections—the presence of consumption, gout or well known hereditary disease, in his family.

(*e*) As to regularity in the habits of proposer.

(*f*) As to his strict temperance in habits, both present and past.

(*g*) As to any point which referee thinks should be known.

(*h*) As to the friend's general opinion of proposer's suitability for insurance,

concluding, in many instances, with

(*i*) As to whether the friend has any financial interest in the assurance to be effected.

Speaking generally, the questions found in friends' reference forms lean too much to the side of medical inquisition, in many instances specific ailments being made the subject of queries which would naturally cause a private friend to pause in his replying question himself whether in replying either "yes" or "no" y not unconsciously fall into some error likely to lead to

trouble for his friend, or his friend's heirs, at some future time. It may be questioned what are these answers worth? Personally I should say that in the majority of cases they are in law worth nothing. I think that distinct collusion to defraud an Office would require to be proved before an insurance could be upset on the ground of incorrect replies contained in a friend's report form. A rather unusual and minute question is found in the form of one Office as to whether the referee is aware of any symptoms or circumstances leading him *to suspect* liability to consumption, spitting of blood, gout, fits, or even to rupture, in the case of his friend. Rather an inquisition; and how unpleasantly damaging to one's friend an injudicious or incorrect answer might prove! A question of uncertain value appears in some forms—"Is proposer likely in your opinion to live as long as any other healthy person of his age (years)?"

Perhaps the most unusual form for the private friends' reference is in use in one Office, being a blank sheet, which is sent with a covering letter indicating merely the points on which information is wanted. I should imagine this is not on the whole a satisfactory plan. It is hardly necessary to do more than allude, in a word, to the rule of all Offices, that under no circumstances would a statement made by a private referee be divulged to the proposer, and agents and inspectors cannot be too careful in observing this rule rigidly should an unexpected reply be forthcoming. On the front of the forms used by most Offices the referee is informed that it is the rule of the Office not to permit the life to learn what replies are given by referees. In every way Offices advisedly convey the impression as strongly as possible that the answers received are held to be confidential.

In isolated instances the private referee's report is too obviously intended as an advertising or canvassing medium; so much so, indeed, as to detract from the direct purport of the form and reduce its value to the Office.

Agent's Report Form.

Passing to the agent's report form, for which perhaps no great enthusiasm exists, not much need be said. The moderate utility of the form in general will be recognised. It is of service to an Office in only a few cases, as no experienced agent seriously believes that his formal recommendation of a life has much weight, or influences the Office. Its use to an Office lies, rather, in its negative than in its positi-

qualities. It is only natural that an agent, having with considerable exercise of tact and loss of time led a proposer to definite action, should regard the insurance as eligible and consequently recommend it. The wish in this matter is apt to be father to the thought. In some Offices the use of an agent's recommendation or report is discarded; in the majority of instances, however, the form remains. Personally, I hardly think Offices would lose much by the absence of an agent's report form. In my own experience I can remember few reports which conveyed much information of great value. If the form be used primarily for focussing the various items of information bearing on a case which may not have appeared in the other papers, then its usefulness is obvious, but in the light of a real safeguard to the Office it does not, I am satisfied, contribute much, and the improved value of medical reports makes the agent's report less necessary. Probably the points of greatest value to the Office in all agents' reports are (1) information as to the object of the proposer in effecting the insurance, (2) exact particulars as to proposer's occupation, and (3) information as to the agent's personal knowledge of the two referees. The usual information called for in such reports relates to length of acquaintance, frequency of meeting, as to any physical peculiarity, also as to any illness known to agent, as to proposer's habits, as to proposer's having any connection with the liquor trade, as to any intention by proposer to reside abroad, as to credibility of referees' statements, and, finally, as to the general agreement of agent with all statements made in the proposal. Some Offices ask for precise information as to a proposer's occupation, and information on this head may often be useful. In some few instances, chiefly in the cases of Offices doing business in the lower social circles, a question is asked—"Are the premiums to be paid by the proposer and from his own resources?" In one instance the form of agent's report is attached to the proposal, which, one might say, is suggestive of the plan of admission to certain institutions where, in addition to one's application, it is needful to bring the recommendation of a proposer and seconder!

Colonial and American Forms.

The forms generally in use by American and Colonial Offices present a marked contrast to those of British Offices, and it will be convenient to make some reference to these separately. Certain features common to foreign forms, as, for instance, the precise particulars required as to past occupations and places

of residence, also, in some cases, as to amounts and character of insurance held by the life, arise from the wide area and varying countries from which business is drawn and from the increased danger in these countries of speculative policies being effected on lives of doubtful character. The medical report forms generally in use are elaborate to a degree: so much so, that while one may express surprise occasionally at an unusually detailed English form one is appalled when confronted with the forms of American and Colonial Offices. In addition to travelling over the entire field of ailments to which human kind seems liable, questions are asked as to the race to which the proposer belongs, as to the colour of his hair, or as to any facial or physical peculiarity by which he might afterwards be recognised. These last points arise from the probable necessity for some means of identification when business is carried on under conditions so different from those prevailing in this country. One naturally wonders why it has not been thought advantageous to adopt forms having reference solely to the conditions prevailing in this country. The medical examiner might well demand larger fees for examination; in some cases a double fee would leave the American Office his debtor relatively. He is even expected in completing one Company's form to report as to anything unhealthy in applicant's surroundings, anything insanitary in his occupation, residence, or place of business, and is finally asked to consider himself for the time being an Insurance Company and say whether he himself would accept the risk. Printed instructions to the Company's medical examiners of quite an elaborate nature are used by at least one American Office. Its uses are undeniable where the officer's services are reasonably often in demand. In passing, I may also mention that where the amount of a proposal is at all large, say £2000 or upwards, American Offices usually require the report of two examiners.

In the proposal form, particulars not always asked for in this country are required; fewer detailed questions are put, but in lieu of these, very binding statements are incorporated in the form of declaration. As an illustration: a proposer declares that he has never been intemperate, that he has not been declined for insurance by any Life Company, nor has he "received a policy different in form from the one originally applied for." A lady proposing for insurance is asked questions as to her financial position which in this country would be resented—such as "Do you own property in your own right?" "What is your source of

income?" and "For how much and in what Companies is your husband's life insured?"

The impression on reading through American and Colonial forms generally is that the Companies hedge themselves about effectually with provisos, stipulations, and warranties, which are declared to be fully understood and agreed to by a proposer—it is certain that in many instances they are not so understood. To the foot of the replies in the private referee's form one Office appends a declaration certifying that no information respecting the life enabling the Office to decide upon his eligibility has been withheld; such a declaration if generally required would lead to refusal to sign. From the point of view of making the Office perfectly "safe" in its transactions the minute accuracy of the American form must be commended; it is questionable, however, whether the adoption years ago of a similar spirit by British Offices would have made Life Assurance as popular as it is to-day. A feature peculiar almost to foreign Offices is the question in the proposal requiring the name of a "beneficiary" under the assurance. The custom, it seems to me, is one calculated to place at a great disadvantage afterwards any insurer who fails to grasp in all its bearings this question of a fixed beneficiary. Should any change in the "destination" of a policy become necessary, legal difficulty would most probably arise to prevent the execution of the assured's wishes, and for most reasons it is better to have the assurance in favour of one's heirs and executors, unless in cases where a definite object necessitating settlement is in view at the time of effecting the assurance. In leaving the question of beneficiary open, the assurance better provides for the unforeseen contingencies that may arise in the course of a lifetime; on the other hand, to settle the policy definitely at the time it is effected may more readily involve its being surrendered, should the object of the first settlement cease to exist. The ethics of surrender do not concern us here!

Other Forms. We can only look briefly at the various supplementary forms not commonly in use. The supplemental medical and proposal forms required to meet special exigencies suggest their utility on reflection. The most common may be named (1) additional medical queries in cases of corpulency; (2) ditto in cases of asthma; (3) ditto in cases of heart affection; (4) ditto in cases where any tendency to con-

sumption is suspected; (5) special queries in cases where ear trouble has existed.

The importance of additional information, if obtainable, in cases involving one or other of these troubles may be great. Offices exercise greater or less care on special points in proportion, perhaps, to their own experience of the disease in connection with their claim lists, and it is by no means the rule for every Office to have a printed form of specific questions on the special ailments alluded to. In the event of no printed form of queries being used, a number of questions dealing with points usual to special cases would be sent to the medical examiner previous to the examination of the life. Special questions on ear troubles (disease of the middle ear, &c.) are not so generally used, but are of great importance from the possible relation to future minute brain affections. In regard to corpulency, there is, I am inclined to think, too much importance attached by some Offices to overweight, especially when met with in proposers about 40, or from 35 to 40. Generations of men have systematically taken insufficient exercise and have lived to good ages. The most common cause of corpulency is absence of exercise, which business pursuits may not readily permit of, and from mere robustness of health a man may put on flesh freely between 35 and 40, and yet at 50, as I imagine often happens, be little heavier than the correct average for his height and years. Other forms in use, referred to in the early part of this paper, need no special description. The most common are, declaration as to insurable interest; declaration as to age; statement and declaration in cases where a Whole World policy is required at the outset.

Some reference is necessary to the matter of the admission of assured's age under a policy. Compliance with the requirement as to proof of age, at any rate during the early years of an assurance, is too often neglected by the assured, and to the agent the temptation is strong to let matters rest after he has successfully carried through indispensable forms; but Companies would gain by making it imperative, as far as possible, that the agent or branch official should adjust the matter of the assured's age once for all so soon as the premium be paid. An offer to obtain proof, in cases where the assured was unwilling to take trouble, at a fee of, say, 5s., in ordinary circumstances, would indirectly react in the Company's favour.

Some description of the procedure in respect to claims under

policies is called for, but in this I must be most brief. On the intimation of a death the Company issues blank forms, usually two or three in all, on which are supplied (1) medical particulars of the last illness and probable causes leading up to the death (this form being completed by the medical attendant); (2) an identification of the deceased with person described in the policy; (3) the actual Registrar's certificate of the death. These forms are simple in character, the information can in nearly all cases be readily supplied, and if promptly completed and returned to the Company they facilitate, in conjunction with the production of Probate, an early payment of the claim.

I should like to close with a reference to the possible contingency of a Life Assurance claim being disputed. This, we admit, happens very infrequently, and, having regard to the conditions surrounding Life Assurance in this country, is not likely to happen often. We naturally, however, try to anticipate the logical outcome of the many exacting questions contained in medical and proposal forms requiring explicit answers to which a proposer stands committed. If these explicit answers are required, is it that they may form the possible basis of a dispute afterwards? If not so, could not these rigid and definite replies in many instances be dispensed with? On the other hand, the more complex society and the business world become the more numerous, it might be inferred, would become attempts to take advantage of Offices by concealing unfavourable points. The mere urgency with which Life Assurance is so constantly presented to the notice of a business community would seem to increase in some degree the danger of defective proposals being successfully carried through, to the ultimate detriment of Offices. On the other hand, it would strike a far-reaching blow at the confidence of the insuring public in Offices if any tendency to contest claims were to arise, so that being almost compelled to meet every claim, short of flagrant attempts to profit by the well-known readiness of Offices to pay, Offices of necessity have continually before them the problem of how best to get at the vital facts respecting each life submitted without giving offence.

On the question of possible dispute under a claim, arising out of some mis-statement, wilful or unintentional, the usual clause as to "Incontestibility" after an interval largely covers the ground, and to my mind the cases of supposed wilful misstatement, involving serious doubt to an Office, which might arise outside the scope

of the very usual five years' limit are so few in number, relatively, that any possibility of disputing a claim may well be dismissed by the Office. Opinions, of course, must differ as to the frequency and seriousness, or otherwise, of misstatements deliberately made. I adhere to the view already stated, notwithstanding the terms of a recent "Detective Agency" circular, addressed to Insurance Offices, in which it was stated that "many Life polices are effected regardless of truth, and after diligent enquiry evidence is often obtained avoiding total liability by the Company." The first portion of this assertion has no value in a relative sense. The detective agency is altogether out of place in the business of Life Assurance. Offices have everything to gain by disabusing the minds of intending insurers, as far as possible, of any idea that they are setting a "trap" in respect to questions asked. Let it be understood that while the Office does not bind the proposer down to a series of answers upon the correctness of which the contract shall hinge, it wishes to obtain such a general view of his present and past physical condition and of his family record as will enable them to judge fairly of the risk they are asked to run.

THE USE OF ALCOHOL AS AFFECTING LIFE ASSURANCE RISK.

By NEIL CARMICHAEL, M.D., F.F.P.S.G.,
Examiner in State Medicine, Faculty of Physicians and Surgeons, Glasgow.

A Paper read before the Glasgow Insurance and Actuarial Society, 8th February, 1904.

LIFE Assurance is founded on the science of probabilities. Many Tables of Expectancy have been compiled, as applying to the general population and also to selected lives. Life Assurance Companies, and most Friendly Societies with a Life Assurance arrangement, select the lives they propose to assure by making a medical examination of the physical condition of the person proposed for assurance, and by inquiry as to their family histories, their occupations, and their habits of life. In this inquiry particular care is exercised to determine to what extent the proposer uses alcohol. Those candidates known to use alcohol beyond what is recognised as moderation are not considered good risks—excessive use of alcohol being known to shorten life.

But the question is raised—Does the use of alcohol in what is usually considered moderation exercise any decided influence on the duration of life such as to merit the serious consideration of Assurance Societies? Does the moderate use of alcohol lengthen or shorten life, and if so, to what extent, and how?

The object of this address is to present some facts bearing on these points, to estimate, so far as at present possible, the influence of the moderate use of alcohol on longevity, and to some extent to seek for explanations.

It may be well to note here that the first Abstainers Assurance Society was formed in 1840. Mr. Warner made a proposal for assurance to a good Company. He was medically examined and found to be in good health. His proposal was

refused at ordinary rates, and he was informed that he would require to pay an extra premium on account of his total abstinence, the opinion then held being that abstinence undoubtedly shortened life. Mr. Warner refused to pay the extra premium, and with some friends formed a Total Abstinence Life Association. In 1849 a general or Non-Abstainers Section was formed in connection with this Association. The premiums charged are the same for both abstainers and non-abstainers, the former receiving any advantage arising from their superior vitality in the form of additional bonus. The bonuses in the Abstainers Section have been much larger than those in the Non-Abstainers Section, and when someone at a meeting of the Institution asked why this was so, the secretary replied that it was because the abstainers would not die at the proper rate.

I had intended placing before you some Tables dealing with the comparative mortality rates of the two sections of this Institution, but since I undertook to give this address a paper has been read to the Institute of Actuaries by Mr. Roderick MacKenzie Moore, actuary, "On the Comparative Mortality among Assured Lives of Abstainers and Non-Abstainers from Alcoholic Beverages." In this address — published in the Journal of the Institute of Actuaries for January, 1904—Mr. Moore, with great elaboration, has compiled a large series of Tables showing comparatively the mortality rates of the two sections.

Mr. Moore shows that the lives assured in the two sections are fairly comparable; that the average sums assured in the two sections are practically the same; that the conditions of acceptance are the same, except that to some slight extent a proposer whose family history or personal condition was somewhat unfavourable had a better chance of acceptance in the Abstainers Section.

The only feature which distinguishes the two sections is that the one is composed of declared total abstainers and the other of persons not so declared. The experience of the Institution examined into by Mr. Moore extends to 61 years. In the Non-Abstainers Section the actual deaths were 100·5 per cent. of the deaths expected as calculated on Office mortality rates. In the Abstainers Section the actual deaths were 74·3 per cent. of the deaths expected as similarly calculated.

TABLE.

Summary of the Ratios of Mortality Rates of Abstainers (per cent. per annum) to those of Non-Abstainers.

Ages.	TAKING NON-ABSTAINERS AS 100, THE ABSTAINERS' RATES UNDER THE VARIOUS GROUPS ARE:—								Ages.
	Males.				Females. (Whole-Life.)	Males. (Whole-Life).			
	Whole Life (OM as 100).	Endowment Assurance.	Rated-Up Lives.			Excluding 1st Five Years of Assurance.	Entrants 1841–1888 during 1841–1901.	New Entrants 1889–1901 only.	
			True Ages.	Rated-Up Ages.					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
–9	...	...	...	...	...	...	...	...	–9
10–14	55·1	25·2	...	...	...	...	128·	...	10–14
15–19	177·	136·	...	...	71·8	147·	160·	...	15–19
20–24	108·	80·2	109·	66·6	106·	45·8	82·7	24·4	20–24
25–29	77·8	93·8	48·4	66·9	71·1	58·2	70·1	104·	25–29
30–34	62·9	94·6	60·2	46·4	137·	51·7	61·3	26·8	30–34
35–39	55·2	65·5	38·5	46·9	87·7	52·7	56·2	42·9	35–39
40–44	54·6	75·7	47·4	46·6	87·4	55·8	59·0	41·2	40–44
45–49	58·7	68·7	52·3	51·7	87·1	55·9	58·8	66·8	45–49
50–54	62·0	78·8	73·0	59·4	87·7	60·7	62·4	70·5	50–54
55–59	71·5	89·1	73·8	64·6	92·7	69·4	71·1	67·1	55–59
60–64	76·7	113·	92·6	74·9	85·2	76·1	78·7	95·0	60–64
65–69	86·9	153·	76·5	91·3	92·8	83·4	84·2	81·6	65–69
70–74	85·1	...	88·3	71·0	113·	86·4	86·2	193·	70–74
75–79	107·	...	126·	115·0	111·	110·	109·	126·	75–79
80–84	93·6	...	89·6	103·	101·	93·7	93·7	84·7	80–84
85–89	85·8	...	51·4	69·9	139·	93·6	89·8	...	85–89
90–94	73·7	...	292·	124·	300·	78·0	78·0	...	90–94
95–99	...	...	...	...	...	...	..	...	95–99

In this Table Mr. Moore gives a "Summary of the Ratio of Mortality Rates of Abstainers (per cent. per annum) to those of Non-Abstainers."

The ratios he calculates for quinquennial periods, from under 9 to 90 years of age. In different columns he deals with all males—whole life; with endowment assurances; with rated up lives, calculated first at true ages and again at rated up ages; with female lives; with males whole life, (1) excluding first five years of assurance, (2) with entrants, 1841 to 1888, during the period 1841-1901, and with new entrants 1889-1901 only.

In all these columns the lower mortality of the abstainers is very marked. Each of these modes of inquiry shows the great superiority of the abstainers' lives.

The effect on the ratios of the two sections due to transfers of lives from one section to the other has been carefully measured by Mr. Moore. There has been in some quarters an impression that the transference of unhealthy lives—possibly taking to drink—from the Abstainers Section to the Non-Abstainers Section materially injures the record of the latter section.

The transference is not made if the alcohol is taken medicinally. The transference from the Non-Abstainers Section to the Abstainers Section of those who have taken alcohol up to the time of transference is disadvantageous to the records of the latter section. "But apart from these facts the transfers have been so "few that their effect can but be insignificant."

Mr. Moore also gives Tables of those transfers with their mortality. The general rate of mortality of the two sections was so little modified by those transfers that their influence may be left out of count. The conclusions of Mr. Moore on his whole inquiry may be stated in his own words:—

"Firstly—That the non-abstainers assured in the Institution "are good average lives, generally equal to the best standard of "assured lives, namely, the O^M Table.

"Secondly—That the abstainers show a marked superiority to "the non-abstainers throughout the entire working years of life "for every class of policy and for both sexes, however tested.

"Thirdly—That this superiority has not been brought about by "the operation of the 'Transfers' between the two sections."

The comparison of the Mortality Tables of three Friendly Societies shows a similar superiority in life-value of the abstaining order.

A Temperance Assurance Association which started in 1881 has had from the beginning two sections—the Abstainers and the Non-Abstainers. Dr. A. Wood Smith and I have been medical advisers of the Company during its whole period of existence. My acquaintance with the details of the work of this Company is therefore direct and intimate.

The mortality rate of this Company for four quinquennial periods and for twenty years is shown in subjoined Table. The claims expected in each section are calculated on the Healthy Males Table.

Period.	Temperance Section.			General Section.			Difference.
	Claims Expected.	Actual Claims.	Ratio.	Claims Expected.	Actual Claims.	Ratio.	
			Per Cent.			*Per Cent.*	*Per Cent.*
1883–1887	43	15	35	11	7	62	27
1888–1892	159	79	50	49	33	68	18
1893-1897	290	138	48	95	67	70	20
1898-1902	444	188	42	164	118	72	30
	936	420	45	319	225	71	26

In the first five years the claims expected were, in the Non-Abstainers Section, 11; the actual claims were 7—that is, 62 per cent. In the Abstainers Section the claims expected were 43; the actual claims were 15—that is, 35 per cent.

In the second quinquennial period, in the Non-Abstainers Section the claims expected were 49; the actual claims were 33—that is, 68 per cent. In the Abstainers Section the claims expected were 159; the actual claims were 79—that is, 50 per cent.

In the third quinquennial period, in the Non-Abstainers Section the claims expected were 95; the actual claims were 67—that is, 70 per cent. In the Abstainers Section the claims expected were 290; the actual claims were 138—that is, 48 per cent.

In the fourth quinquennial period, in the Non-Abstainers Section the claims expected were 164; the actual claims were 118—that is, 72 per cent. In the Abstainers Section the claims expected were 444; the actual claims were 188—that is, 42 per cent.

For the twenty years, in the Non-Abstainers Section the claims expected were 319; the actual claims were 225—that is, 71 per cent. In the Abstainers Section the claims expected were 935

the actual claims were 420—that is, 45 per cent. So that for the twenty years' period the ratios of actual to expected claims in the two sections were 71 per cent. and 45 per cent.—a difference in favour of the Abstainers Section of 26 per cent. What is the significance of this difference? Is it accidental?

The difference, though subject to some variation, is marked and continuous throughout the whole period. Such comparative uniformity of result implies some constant condition or conditions influencing the two sections differently in respect to their mortality.

Some light may be thrown on this question by an examination into the causes of the deaths in the two sections.

I have prepared a Table dealing with all the deaths that have taken place in the twenty years of the Company's experience.

Abstainers Section.		General Section.			
Disease.	Actual Deaths.	Actual Deaths.	Deaths if in Proportion to Experience in Abstainers Section.	Excess.	Percentage of Excess over Column (2).
(1)			(2)	(3)	(4)
Influenza,	10	10	3·4	6·6	194
Nervous Diseases,	33	28	11·2	16·8	150
Rheumatic Fever,	4	5	1·3	3·7	284
Heart, Etc.,	52	27	17·7	9·3	52
Cancer,	19	10	6·4	3·6	56
Phthisis,	108	42	36·8	5·2	14
Other Respiratory,	63	34	21·4	12·6	58·8
Liver,	5	5	1·7	3·3	194
Abdominal,	42	16	14·3	1·7	11·8
Kidney and Urinary,	22	13	7·4	5·6	75
Accident,	19	13	6·4	6·6	103
Suicide,	3	4	0·9	3·1	344
Fevers,	30	14	10·2	3·8	37·2
Sundries,	10	4	3·4	·6	17·6
	420	225	142·5	82·5	
			225		

This Table shows (1) the causes of death and the numbers dying from each cause in the two sections; (2) the number of deaths from each cause which would have taken place in the Non-Abstainers Section if the deaths in this section had been in accordance with the experience in the Abstainers Section; (3) the excess of deaths from each cause in the Non-Abstainers Section over the deaths which should have taken place according to the experience of the Abstainers Section; and (4) the percentage of this excess to the number of deaths which should have taken place according to the rate in the Abstainers Section. From the Table it will be seen that the deaths in the Non-Abstainers Section are in excess of those in the Abstainers Section in all classes of disease. The excess is not limited to one class of disease, and is not counterbalanced by an excess in any class of disease in the Abstainers Section. It is recognised that excessive drinking tends to produce certain diseases, and the Registrar-General has shown in his Annual Report for 1897 that in certain trades associated with the manufacture or sale of alcohol in its various forms the mortality from certain diseases is very great. Amongst those diseases he places—diseases of the nervous system, diseases of the liver, influenza, rheumatic fever, and diseases of the heart and circulatory system. If we look at our Table we find that the excess of mortality in the Non-Abstainers Section from the diseases just mentioned is very considerable. In diseases of the nervous system the excess is 150 per cent.; in diseases of the liver it is 194 per cent.; in influenza, 194 per cent.; in rheumatic fever, 284 per cent.; and in diseases of the heart and circulatory system, 52 per cent.

It may be objected to the use proposed to be made of this Table that the numbers in the case of some of the diseases are so small as not to justify decided conclusions. This objection is well founded. The liability to error is great in dealing with ratios from small numbers. But these small figures are fractions of larger numbers, namely, those exposed to risk. The value of inferences from numbers not large depends on the uniformity of their indications, and this depends on the uniformity of action of the influences determining them.

In the Table before us we find that in all classes of disease, and most markedly in those acknowledged to be frequently caused by excessive drinking, the Non-Abstainers' mortality is higher than that of the Abstainers. The comparative uniformity of

results strongly bears out the inference that there is comparative uniformity of influence. It cannot but be significant that when dealing with 645 deaths we find that in every class of disease the heavier mortality is with the Non-Abstainers. It certainly is desirable that this investigation should be carried out with much larger numbers, but meantime this tentative and provisional investigation, in view of the consistency of its results, must be looked on as pointing clearly to some deteriorating influence operating on the Non-Abstainers.

Is it the case that this excess of deaths has resulted from excessive drinking? Is the difference between the two sections to be so accounted for? I think not. It is to be noted that there is excess of mortality in the other classes of disease not recognised as caused by excessive drinking. It is probable that some small portion of the excessive mortality is to be accounted for by what may reasonably be termed excessive drinking. This, however, could only be a very small portion, considering, amongst other things, that habits are carefully inquired into by the Company, and that the slightest suspicion of excess, occasional or habitual, causes the proposal to be declined. It can hardly be supposed that the 26 per cent. excess of deaths in the one section over the other could be accounted for by excessive drinking as ordinarily understood. The Non-Abstainers Section has a very low mortality compared with Healthy Males Tables, notwithstanding that this section has not the advantage of the mixture of abstainers which "Healthy Males" has. In the Non-Abstainers Section there are a number of abstainers not willing to make a declaration to that effect, as they look upon the declaration as a kind of pledge, and they desire, as they say, to retain their freedom, and many who are almost abstainers, rarely tasting alcohol in any form. If we take these exceedingly moderate lives as not likely to die of excessive drinking, then the prevalence of excessive drinking amongst the remainder must be remarkable, if this is to account for the excess of mortality.

To what is the excessive mortality due? Considering that the excess is manifested in all classes of disease, and, as shown by Dr. Moore's paper, at all ages, we must conclude that it is due to some influence operating wholly or mainly on one section. But we have seen that the two sections are fairly comparable on all points except as to their relation to the use of alcohol. From my personal experience I can say that I know of no other feature

which distinguishes the two sections. The one section consists of good lives not using alcohol in any form, the other section consists of good lives using alcohol in moderation.

This brings us to the crucial question—Is the greater mortality of the one section as compared with the other due to the influence of alcohol used in what is known as moderation? Is it the case that the moderate use of alcohol produces gradually a deteriorating influence on the vitality of the individual?

Excessive use of alcohol injures tissues, organs, and functions. Does the moderate use of alcohol immediately or after long continuance produce deleterious effects on the system?

Alcohol taken in small quantities produces decided effects; if it did not it would not be used. The effects produced are usually described as stimulating. These effects are manifested mainly on the digestive organs, on the nervous system, and on the circulatory system. There is produced a feeling of satisfaction and fitness. Alcohol in small quantities is, therefore, said to stimulate. It is supposed to do so by adding energy to the system, or by setting free energy already stored up. This explanation is disputed by physiologists. It is now understood that the action of alcohol is in line with the action of other narcotics, and that the effects produced are not those of stimulation but of paralysis.

Physiological tests have shown that alcohol in small quantities lessens the excretion of carbonic acid—that is, lessens the activity of the processes of combustion in the system; that it dilates the blood vessels, particularly of the skin, and that it lessens the power of normal regulation of these vessels by its action on the vaso-motor centres, producing in them a degree of progressive paralysis; that it lessens the acuteness of the sense of touch and of the sense of vision, both as to quickness of perception and as to the power of the eye to accommodate itself quickly and accurately for different distances; and that it lessens the tension of the pulse and increases the rate of the blood flow in the cranium. These are a few of the physiological results of the action of small quantities of alcohol. They are only detectable and measurable by careful physiological analysis; they are not such as to be readily discovered by the unskilled observer. Does the reproduction of these effects, whether we call them stimulating, paralysing, or irritating, once, or more often, daily over the period of a man's life, fail to leave any evidence? When larger quantities of alcohol are taken, symptoms are produced which are easily detected. The

face flushes slightly—a further paralysis of vaso-motor nerves is produced; the speech becomes a little thick and the gait a little uncertain—effects due to the extension of the paralytic action. Here we have decided evidence of injurious influence from considerable quantities. Does the habitual use of alcohol in small quantities produce an injurious effect on the functions and tissues of the body?

The late Dr. Parkes of Netley caused six soldiers to march twenty miles a day for six days—two with alcohol, two with coffee, and two with extract of meat. The work was performed with greater difficulty with the alcohol. This is one of many illustrations of the fact that small quantities of alcohol interfere with function, although the individual is not conscious of this.

The experience of Sir Garnet Wolseley in the Red River Expedition showed that the men endured fatigue better without than with alcohol.

From returns furnished by regiments in India in which the total abstinence societies are strong, the following figures are obtained :—

	3978 *Abstainers.*	8829 *Non-Abstainers.*
Admission to Hospital,	1·812=45·5%	8887=100·6%
Invalided to hills, ..	1·88	3·82
" England,	·603	2·93
Deaths per 1000,	2·7	9·5

We have the fact that alcohol in excess produces well-known forms of disease which are frequently fatal. We have the fact that small quantities of alcohol produce disturbance of physiological functions. We have the fact that the mortality of non-abstainers is in excess of that of abstainers, and that this excess, while decided in all classes of disease, is most marked in those diseases acknowledged to be frequently produced by excessive drinking. And we have the fact that non-abstainers and the abstainers in the Insurance Societies are fairly comparable in all points, except that the one uses in moderation and the other abstains from alcohol.

The explanation which seems best to accord with the facts is that the continuous and cumulative action of alcohol in small quantities on the tissues and the functions of the human organism produces slowly a deteriorating influence, lessening vital resistance to the influences causing disease, and directly producing, slowly and in less marked degree, the diseases which a more free use of

alcohol would cause with greater rapidity and certainty, and in more obtrusive form.

This inquiry which I submit to you is tentative and provisional. Further investigation of the points raised is much to be desired. Sickness Tables, showing the percentage of attack and the duration of diseases and the percentage of death among those attacked for abstainers and non-abstainers, would prove of great value. Such Tables would enable us to form an opinion (1) as to the greater or less susceptibility of one or other class to attack of disease, and (2) as to the vital resistance to disease of those so attacked. It would also throw light on the question whether the influence exerted was mainly that of lowering general vitality, or that of directly producing diseased conditions.

For Insurance Companies such questions are worthy of further investigation. Meantime it is evident that great care—perhaps more than has been in the past—should be exercised to ascertain with some degree of precision the habits of the proposer as to his use of alcohol.

VARIETIES OF LIFE INSURANCE.

By MORRIS FOX,
Actuary to the New Zealand Government Life Insurance Department.

A Paper read before the Insurance Institute of New Zealand, September 11, 1902.

The paper which I have the honour to present to the Institute to-night deals with a subject that is of perennial interest to all classes of life insurance officials. To actuaries, because they are concerned in framing the rates and making arrangements for dealing with the various forms of insurance in the valuations and bonus allotments. To the non-actuarial departments at Head Office, also, the matter is of considerable importance, as the introduction of new methods of insurance will always necessitate new policy forms, and not unfrequently special care at the outset in general treatment, changes of policy, correspondence, and other ways. But to the branch manager and his agents the subject appeals with peculiar force, for, unless they are supplied with a good selection of the various forms of insurance with which to satisfy public requirements, they are seriously handicapped when competing against rival agents who are better equipped. And lastly, if the attention of those members of the Institute who are engaged in other branches of insurance is not temporarily arrested by what I have to say, it will be due to lack of skill in the saying and not to any inherent weakness in the subject under treatment.

At the outset I would remind you that, although there are countless possible varieties of insurance, they are all, however complicated, compounded of very simple elements. For example, an endowment (not an endowment insurance) is familiar to all as being a sum of money, say £1, payable at a certain age *if the life endowed be then alive.* Of 89,865 persons living at age 30, there will remain (by the H^m Mortality Table) 58,866 alive at age 60, and the single premium at 30 for an endowment of £1 at 60 will be that fraction of £1 represented by $\frac{58866}{89865}$, after discounting it for the term of 30 years at the chosen rate of interest. In the same way we may take

The Elements of Life Insurance.

endowments payable at the end of one year, two years, and so on to the limit of life; and an *immediate* life annuity of £1 per annum at age 30 will be seen to be the sum of a series of endowments of £1 each, payable at the end of one year, two years, and so on up to the limit of the table of mortality used. Similarly, a *temporary* life annuity, at age 30, of £1 per annum for 30 years, will be the sum of a series of endowments of £1 each payable at the end of one year, two years, and so on up to 30 years; and again, a *deferred* life annuity (deferred, say, 30 years) will be the sum of a series of endowments of £1 each payable at the end of 31 years, 32 years, and so on to the limit of the mortality table.

Now, taking an example of an opposite nature, you are aware that a temporary insurance for one year is an insurance payable at the end of the year, *provided the life insured dies during the year.* We see that, by the H^m Table, of 89,865 alive at 30, 694 will die during the first year, 706 during the second, and so on. Thus, the single premium at 30 to provide the sum of £1 payable in case of death during the first year will be that fraction of £1 represented by $\frac{694}{89865}$, discounted for a year, and the single premium for £1 payable in case of death during the second year will be $\frac{706}{89865}$, discounted for two years, and so on to the limit of life; and a whole-life insurance of £1 at age 30 is the sum of a temporary insurance for one year and a series of similar temporary insurances deferred one year, two years, and so on to the limit of the mortality table.

A little consideration will show that the most complicated policies on single lives are merely combinations of these simple ingredients in varying proportions.

Classification of Varieties.

It is difficult to classify the various methods of insurance except in very broad divisions, as most of them are, generally speaking, "blends." The French Companies divide their business very conveniently into:—

(1) Assurances en cas de décès; and

(2) Assurances en cas de vie.

The second class (to which the description of "assurances" is unsuitable) comprises endowments and annuities, and the first class refers to life insurance. I propose to divide the first class a little further, into Life Insurance for Family Provision, Combined Life Insurance and Investment, and Children's Insurances, to

which I have added Annuities, and Miscellaneous Varieties of Insurance.

LIFE INSURANCE FOR FAMILY PROVISION.

Whole of Life Insurances. Under the simplest form of this well-known and popular method of insurance the premiums are uniform and payable till death, when the sum assured and bonus become due. The earliest modification was that by which the premiums were made to cease after a number of years. This latter class, however, which goes by the name of the limited-premium policy, has never been in very great demand, doubtless owing to the necessity for the payment of higher premiums.

Limited Premiums.

Absolute Insurance. An attractive feature has, however, been added to this policy which has considerably increased its popularity. In the "Absolute" or "Complete" policy each premium paid secures a "paid-up" policy for a sum in exact proportion to the whole sum originally insured which the number of premiums paid bears to the whole number stipulated for in the policy. Thus, if five premiums have been received on a 20-year policy for £1000 and the sixth premium is not paid within the days of grace the policy becomes automatically paid-up for £250, generally with the bonuses already allotted in addition, and the reduced policy sharing in future profits. This principle is also applied to endowment insurances.

Reducible Premium Insurance. A further modification is for the premium, higher at first, to be subject to a guaranteed reduction at specified periods, the payments being entirely extinguished in 20 years, so that the older the policy becomes the smaller are the premiums, until in 20 years the policy is fully paid-up. This feature has been recently adopted by a leading English office in the shape of a whole-life policy without profits, containing valuable options in regard to paid-up insurance, surrender and loan values.

Summary of Insurance in force. The following summary of insurance in force at the present time and about ten years ago shows that whole-life has not increased in nearly the same proportion as endowment insurance.

SUMMARY OF ORDINARY INSURANCE IN FORCE.

(1)–United Kingdom.

Assurances.	1891. Sum Assured.	1891. Percentage.	1901. Sum Assured.	1901. Percentage.
	£		£	
Whole Term of Life	378,771,496	83·5	420,817,594	66·4
Limited No. of Payments	18,016,300	4·0	32,256,056	5·1
	396,787,796	87·5	453,073,650	71·5
Endowment Insurance	42,483,492	9·4	157,209,831	24·8
Joint Lives	2,594,303	·6	4,115,058	·6
Last Survivor	1,886,222	·4	1,810,858	·3
Contingent	3,812,087	·8	4,683,223	·7
Issue	2,286,889	·5	3,642,643	·6
Miscellaneous	3,814,509	·8	9,458,092	1·5
——	£453,665,298	100·0	£633,993,355	100·0

(2)–Australasian Colonies.

Assurances.	1891. Sum Assured.	1891. Percentage.	1901. Sum Assured.	1901. Percentage.
	£		£	
Whole Term of Life	44,374,663	61·3	49,858,535	53·7
Limited No. of Premiums	2,498,801	3·5	3,396,221	3·7
	46,873,464	64·8	53,254,756	57·4
Endowment Insurance	24,887,970	34·4	38,518,351	41·5
Temporary	68,924	·1	155,660	·2
Deferred	500	·0	307,075	·3
Joint Life	501,992	·7	517,210	·5
Survivorship	4,300	·0	500	·0
Contingent	8,850	·0	52,686	·0
Miscellaneous	4,042	·0	54,484	·1
——	£72,350,042	100·0	£92,860,722	100·0

(3)–Three Largest American Offices.

Assurances.	1891. Sum Assured.	1891. Percentage.	1901. Sum Assured.	1901. Percentage.
	£		£	
Whole Term of Life	167,157,173	51·3	279,708,335	42·4
Limited No. of Premiums	94,376,150	28·9	224,946,451	34·1
	261,533,323	80·2	504,654,786	76·5
Endowment Insurance	63,351,050	19·4	148,247,350	22·4
Temporary	607,273	·2	6,030,757	·9
Joint Life	510,962	·2	1,399,496	·2
Survivorship	11,979	·0	13,011	·0
——	£326,014,587	100·0	£660,345,400	100·0

(1) The particulars for the United Kingdom were taken from the Board of Trade Returns for 1892 and 1902, and do not include the English business of American and Colonial Companies. On the other hand, they include the business of British offices taken on the Continent of Europe, in South Africa, Canada, and elsewhere.

(2) The particulars for the Australasian Colonies were taken from the nearest available valuation statements, and include the business of Australasian Companies taken in the United Kingdom, South Africa, and elsewhere, but do not include the Australasian business of American Companies.

(3) The particulars of American business relate only to the three large offices operating in Great Britain, and include the whole-world business of these offices.

The figures given in the summary are, therefore, only roughly approximate.

The points in connection with the foregoing summary to which I wish to draw your attention are, first, that whole-life and endowment insurance comprise the vast bulk of the business in force throughout the world; and, secondly, that during the last ten years endowment insurance has increased to a far greater extent than whole-life insurance.

In the course of a presidential address to the Institute of Actuaries, about nine years ago, the late Mr. Benjamin Newbatt said :—"No one with an extended experience of assurance matters "can have failed to note and to lament the numerous cases in "which the obligation to pay a premium for assurance has so "long survived the power of providing it as to constitute a "grievous and sometimes an intolerable burden. It will not be "one of my achievements, nor even, probably, an achievement "of my day and generation, but I commend to others the "possibility of making premiums for whole-term assurances "generally terminable at a fixed age, without increase of rate." I agree unreservedly with these views, and it may be interesting to note that two rather important variations in the whole-life policy have been recently adopted by a Scotch Proprietary Company and an Australasian Mutual Office. In the former Company's prospectus the premiums have in all cases been made to cease at age 70, and in the latter the premiums not only cease, but the sum assured and bonuses become payable, at age 80. It is probably a fact that few people need or desire insurance protection after they arrive at the age of 75 or 80, and although it may appear to the average young person that the benefit looms somewhat small in the distant future, it is an undoubted fact that one of every seven now living in this country at age 15 will, on the average, live to be 80; or, put in another way, out of 35,000 people aged 15, approximately 5000, or nearly 15 per cent. of the total number, will live to be 80 or more. Moreover, there are two important considerations which should not be lost sight of in this respect. In the first place, a whole-life insurance is simply an extreme form of endowment insurance, the endowment age being taken as 98, the limit of the H^m Mortality Table, and in the second variation referred to above this limit is merely changed from 98 to 80. And secondly, this shortening of the term of the policy has so small an effect that the enhanced benefit is obtained for

Two Modern Variations.

an almost nominal increase in the premium. At age 15 the additional premium is approximately 4d.; at age 20, 5d.; at 25, 7d.; 30, 9d.; and even at age 35, only 1s.

Assessment Insurance.

It is now necessary that I should say a few words on the subject of Assessment Insurance, which started in America in 1869 as a result of the want of confidence engendered by the many failures of "Old-Line" Companies about that time. As originally carried on by the Fraternal Orders, a fixed rate was collected at death, irrespective of the age of the member, and the proceeds were paid to the beneficiaries. No reserves were maintained. Later on crude rules were adopted making the assessments vary somewhat with the age, but this was found to be unpopular, and members in good health lapsed in large numbers as the assessments increased, leaving the unhealthy members behind to take care of themselves, with what results it is needless to say. The scheme has been well described as "Graveyard Insurance." The growth of these Fraternal Orders induced the formation of regular assessment Companies, employing agents and conducted from a business, not a fraternal, standpoint. But, although improvements were certainly effected from time to time, the main principle underlying the system is unsound, namely, that the cost of insurance can be kept down permanently by the acquisition of a constant stream of young new members to take the place of those dying and lapsing, thus keeping down the average mortality of the general body of members. The lamentable experience of the majority of these Companies shows that this cannot be done in practice, and many of those which are left are improving themselves on to an "old-line" basis and charging the same as the regular companies, sometimes passing through a transition stage before doing so by practising what is known in America as the "Flexible-Premium" plan, which occupies an intermediate position between assessment and "old-line" insurance.

Demand for Cheap Insurance.

I might perhaps have been excused if I had omitted "Assessmentism" altogether from my programme, for it has been truly said that it is no more life insurance than a gilded exhibition pyramid is pure gold. But assessmentism, notwithstanding its inherent badness, has been of service to life insurance indirectly. The influence of the competition of the assessment Companies in Great Britain was very powerful at one

time, and the result was that a keen demand was created for a cheaper form of insurance than the ordinary whole-life policy offered by British offices. This led to efforts on the part of those offices to supply insurance on sound lines to meet the demand, and was the cause of the adoption of some of the schemes which I shall now describe.

A shrewd and witty insurance agent is reported to have said: "The chief obstacle to taking out a life policy is the necessity of having to pay premiums." I suppose there is a good deal of truth in this, but in any case agents can always sell insurance at a very low premium, though it is to be feared that the public do not always get just what they want.

Without-Profit Insurance. This is a method of insurance of very long standing, and is useful when it is desired to get the largest possible definite cover for purposes of security, or, in the old country, to provide for the payment of death duties. It does not, however, meet the demand for cheap insurance as a family provision, for we have it on very high authority that these policies usually relate to financial transactions and business of that kind, it being almost unknown for a person to insure non-profit for provident purposes. Both at home and in the Colonies the business done under this head is very small in relation to the with-profit business.

Deferred Bonus Policies. In this class of policy the premiums are usually slightly above non-profit rates, but in addition to the sum assured being guaranteed the policies share in profits on arrival at a certain advanced age, or when the premiums, accumulated at 4 per cent. compound interest, amount to the sum assured. One large Scottish institution transacts the whole of its business on this basis, and has conducted its operations for over sixty years with pronounced success. A London office tontines the bonuses in this class until age 50, 60, or 70, as selected, keeps the Bonus Fund separate for each class, and allots the fund, at the tontine age, in proportion as the premiums paid by the assured are to the total premiums paid by all surviving policy-holders in that class at the close of the last quinquennium. Some difficulty is likely to be experienced in transacting this class of business together with other classes of insurance. It is, however, an equitable and well-defined contract with no objectionable features, and yet I am not

aware that it has attained any great popularity except in the case of the Scottish office to which I have alluded.

Renewable Term Policies.

The difference between assessmentism and renewable term insurance is that, while in the former the members were charged about half the usual rates of premium and taught to believe that there was little, if any, likelihood of an increase being required, the latter form is theoretically and scientifically sound. The premium increases every year with the increase in the rate of mortality, but the Company is bound to renew the insurance annually without medical re-examination. The investment element is thus entirely eliminated from the contract, but the inevitable result is that the premiums rise to an impracticable height in old age. It is sometimes the practice to charge entrance fees of £1 per policy and £1 per cent. on the sum assured; the polices do not acquire any surrender value. It is, however, highly inconvenient in practice for the premiums to change every year, and although offices of good reputation both in England and the United States have given the method a fair trial, they have not met with very great success.

Credit Insurance.

This method of obtaining insurance at a very low cost was introduced many years ago to suit those cases (not by any means unusual) where it is desired to secure as large a cover as possible for the smallest possible present outlay, the proposers expecting their circumstances to improve so that they will be able to pay an increased premium later on. The general plan is to allow a certain proportion, from 20 to 50 per cent., of the premiums to remain a debt for five or seven years, secured by the policy and bonuses, and generally bearing 5 per cent. interest, payable annually with the balance of the premium. No surrender value is allowed until the debt has been extinguished by the application of bonuses or otherwise, and if the policy is discontinued during the earlier years an advantage may be gained over the ordinary policy-holder, because the debt left on the policy is generally more than the surrender value of an ordinary policy. It is necessary that the proportion of the premium that is paid shall not be less than the premium for a short-term policy for the five or seven years, so that if the insured discontinues the policy before the full premium is paid the office receives sufficient for the risk. In one of the best offices 25 per cent. of the premium is allowed to remain a debt at 5 per cent. interest, and the bonuses, which are

very large, are applied in the first place to extinguish the debt, then to permanently reduce the premium payable to three-fourths of the ordinary premium, and afterwards as may be preferred. I think the weakness in the method lies in the fact that in real life it is not unusual to learn with astonishment that one's expenditure generally increases at least as fast as one's income.

Half-Premium Method.

The existence of a debt on the policy and the payment of interest constitute objections in the minds of some to the "Credit Policy," and in order to meet these objections what is known as the "Half-Premium Policy" was introduced. For the first five years the premium is very small, being half, or about half, that payable during the remainder of life, and only slightly in excess of the premium for a five-year short-term policy. In the meantime no debt attaches to the policy, so that in case of death during the five years the whole sum assured is secured for a very small premium. This result is obtained by making the premium for the rest of life after five years a little higher than the ordinary premium at the age at entry. Bonus and surrender values accrue after the expiry of the first five years.

The main objection to this method of insurance is contained in the following remarks of an English actuary :—"There must be taken into consideration an element which we, not as theorists, but as practical people who are trying to meet a practical demand and who live by the public, cannot ignore—the curious fatality which seems to prevent the average man from understanding the intricacies of life insurance contracts. Many of us have had experience of such a simple matter as a policy issued at a reduced premium for the first five years and a larger premium for the remainder of life. We know the patience with which the underlying principles of the contract were hammered into the proposer's head when the proposal was taken, and the innocence with which, when the sixth payment came round, he tendered the same premium as during the first five years, and not only failed to appreciate the relief already given him, but seemed to think it was the result of a deep-laid conspiracy that he had to pay any more."

I am not so sure, however, that the underlying principles are always so persistently hammered into the heads of proposers by the agents themselves. Of course the office may, and should, issue explanatory leaflets, but I do not imagine that the average agent

is likely to draw particular attention to the unpalatable features of the goods he is selling any more than is customary with commercial travellers in other lines of business. The natural result must be a heavy lapse-rate at the end of the five years, and, although I once had a leaning towards this policy, further experience has caused me to admit its disadvantages.

There are other modifications of an ascending scale of premiums, such as the substitution of seven for five years, and the premiums being increased on more than one occasion, but the half-premium method is the most usual one.

Discounted Bonus Policies.

The discounted-bonus policy is one of the results of the demand for cheap insurance most in evidence in the old country. A portion of the bonus anticipated to be realised in the future is treated as surrendered by the assured, its value being applied to reduce the premiums from the outset. The rate of bonus discounted differs greatly, ranging from 20s. per cent. per annum of uniform-reversionary bonuses in some offices to 40s. per cent. in others. The most common practice is to stipulate that, in the event of bonuses falling at any time below the rate anticipated, the sum assured shall be reduced, or the premium increased, accordingly. Two papers dealing with the theory and practice of the method have been read before the Institute of Actuaries, and the subject was very fully discussed. In these discussions it is noticeable that, although the system is supported by some of the leading actuaries and practised by some of the best offices in the world, it receives the severest condemnation at the hands of many actuaries with the very highest reputation for ability and business acumen. I am entirely in sympathy in this matter with the latter class, for I feel very distrustful of policies whose benefits are dependent on the profits earned in the future, and maintain that the benefits mentioned on the face of the policy should be defined and guaranteed, and that profits should only be available in any shape when they have actually been made and gathered in. I therefore take some pleasure in summarising the objections which have been set forth to this class of business :—

1. The contract lacks stability and is not definite.

2. The system contains one of the undesirable features of assessmentism, the substitution of a policy under which the sum assured is liable to reduction or the premium to increase,

in place of the familiar guaranteed contract at a fixed premium.

3. The liability to decrease of sum assured or increase of premium interferes with the value of the policy as a security.

4. It is difficult to preserve strict equity between two classes of participating policy-holders unless their funds, investments, bonuses, &c., be kept rigidly apart.

5. If a policy-holder found his sum assured gradually diminishing at each "division of profits" (?) he would not be slow to inform his friends of the full irony of the expression.

6. Policy-holders are not likely to understand the contract, and, however safeguarded, the reductions are sure to be looked on as permanent.

7. Any variation of the premium or sum assured would be looked upon as a distinct failure on the part of the office to faithfully carry out the contract and would shake public confidence in actuarial methods, thereby causing the prestige of life insurance to suffer severely.

Whatever advantages there are in the discounted bonus scheme may, however, be retained without objection *if the face of the policy is guaranteed*, and this may be done if a very cautious estimate is made of the proportion of bonus discounted. In return for this guarantee, the full-profit policy-holder should be recompensed, and this may be conveniently arranged by leaving a margin between the bonus discounted and the rate above which the reduced premium policies shall participate; or, if preferred, a small constant loading may be added to the premium. One class of policy-holders would thus assume a small additional risk, for which they would be paid, thus maintaining the spirit of equity and making each section self-supporting. One English office discounts two-thirds of the ordinary bonuses, and another discounts future bonuses at the rate of 20s. per cent. per annum, both offices guaranteeing the sum assured and premium from alteration unfavourable to the assured.

Enlargeable Term Insurance. This usually takes the form of a long-term insurance with the option of transfer to any ordinary Table without medical re-examination, provided the transfer is applied for five years before the term expires. The small additional premium necessary to compensate the office for this option i-

easily ascertained, and the method is both sound in theory and popular in practice. From a presidential address to the Insurance and Actuarial Society of Glasgow I gather that this is the most common of the forms of life insurance for family protection devised to compete with the assessment system in supplying cheap life insurance.

Reversionary Annuities.

Instead of a lump sum being payable at the death of the assured, an annuity is payable to his widow for the rest of her life. If the wife dies first, however, the policy terminates and nothing is payable then or at the death of the assured. For this reason, doubtless, this particular form of protection has never been much sought after.

Protective Annuities.

Another variation is for an annuity to become payable on the death of the assured until the expiry of the original term of the policy. Thus, if the term of 20 years were selected and the assured died after 13 years, the annuity would be paid for 7 years, while if he survived the whole term of 20 years the contract would terminate, the required protection having been enjoyed.

Instalment Policy.

The instalment policy is a form of insurance which prevents the principal being lost by a bad investment or dishonest trustees. Instead of the sum assured being paid in one sum it is made payable in annual instalments over a term of years. Thus, instead of £2000 at death, £100 a year would be payable for 20 years or £200 a year for 10 years, the premium being naturally considerably less than if the sum assured had been payable in one sum on the death of the assured. In America it is usual to assume 3½ per cent. interest in reference to the instalments if they are payable for five years only, decreasing the rate by ¼ or ⅛ for every five years the term is extended. Provision is made for the payment of any instalments remaining unpaid at the death of the beneficiary to the heirs when they fall due, or in a commuted sum.

Another arrangement is to charge the usual premium for an insurance of £1,000 and issue a contract for the payment of a considerably larger sum in equal annual instalments, not exceeding thirty. For example, an ordinary £1000 policy might be spread over 10 yearly payments of £113 to £119, 15 payments of £81 to £86, or 20 payments of £65 to £70.

Continuous Instalment Policy. A further development is the continuous instalment policy, which provides for the instalments being paid until the death of the beneficiary in the event of the latter living beyond the term of years originally chosen. When the term is 20 years this policy is sometimes called the 5 per cent. continuous instalment policy, as each instalment is 5 per cent. of the full sum assured.

20-year Convertible Insurance Bond. A New York Company issues a policy containing a guaranteed surrender value, which value is paid with the sum assured at death during the 20 years, and on arrival the sum assured and surplus are paid, and the Company agrees to then issue a new renewable-term policy without medical re-examination, if desired.

COMBINED LIFE INSURANCE AND INVESTMENT.

Endowment Insurance. The familiar and popular endowment insurance is composed of a temporary insurance payable during the term of the policy and a pure endowment for the same amount payable at the end of the term in the event of survival. As has been shown on page 79, this class of policy has increased largely during the last ten years, and thirty years ago it was very little in evidence. It was not then looked on with much favour by orthodox insurance managers, as it was considered objectionable to introduce such a large element of investment, which has the effect of decreasing the amount of family provision obtainable for the same premium. It is said that one insurance office would not adopt this policy for many years, on the ground that the public, if they wanted it, could already procure from that office a term insurance and a pure endowment. However, it seems that the public did want it, and in the convenient form in which it is now presented, and the office in question learnt by experience that what the public really wants it will have, so that eventually it was compelled by force of circumstances to fall into line with its competitors.

Endowment insurances in their original form have multiplied largely during recent years, and they are by far the most popular kind of insurance in the Colony. When made to mature from 55 to 65 years of age, I think they afford about as good a way as any of making a reasonable family provision together with a nest-egg for oneself when both are most required.

American Competition.

Since the advent of American companies in Great Britain, and later in the Colonies, however, their abnormal activity and ingenuity in furnishing new schemes, developing the investment element particularly so as to make it appeal to the speculative instinct, has had the effect of stimulating their slower-moving British cousins in the same direction, one result being that the forms of insurance now offered under the designations of debentures, consols, gold bonds, guaranteed dividends, accumulation policies, &c., are almost too numerous to describe. I will, however, draw your attention to some of the leading varieties. It may appear curious that the increase in the cheaper forms of life insurance designed particularly as a provision for the family should have taken place concurrently with a remarkable development of endowment insurance, but probably it is because they appeal to different sections of the community.

One of the most notable features of the schemes rendered attractive by the American companies is the offer of various options of dealing with the policy at death or maturity. It has long been the practice of British and Colonial offices to announce in their prospectuses that surrender values and paid-up policies would be granted on application, and also that the insured or his representative might convert the proceeds into an annuity (amount indefinite); but the Americans have decidedly gone one better in clearly defining these options and stating them in the policy itself.

Guaranteed 4%, 5% or 6% Investment Insurances.

These insurances go by the names of the guaranteed interest debenture, the guaranteed income bond, the trust investment policy, the family settlement policy, amongst others. In the case of a whole-life policy the bonuses may be drawn at death and, say, 5 per cent. allowed on the face value of the policy for, say, 20 years, or sometimes only till the death of the beneficiary, when the face value is paid; or 5 per cent. may be paid on the sum assured and bonuses for the 20 years, when the full policy is payable. In the case of an endowment insurance, the insured would receive 5 per cent. on the policy from maturity, and the policy itself would be paid in full at his death, or in some cases at the end of the 20 years. It is customary to allow the option of a cash settlement of £1200 to £1300 at death or maturity, and not less than £1000 at any

time after death or maturity. When the policy provides merely for the payment of a life annuity to the widow after the death of her husband and the sum assured on the death of the survivor, the contract consists of a reversionary annuity of £50 and a last survivorship insurance of £1000. I believe it is usual, however, to base the calculation on the ordinary office premiums by assuming that the office will be able to earn, say, 3 per cent. on its funds for the remainder of the contract after the death of the insured or the maturity of the policy, and to provide for a deferred annuity of 1 per cent. if 4 per cent. interest is payable, or 2 per cent. if 5 per cent. interest is allowed.

Trust Certificates.

A popular form of insurance for wealthy men in the States is the trust certificate, in which the Company is nominated as the trustee and pays a yearly specified sum to the beneficiary out of the proceeds of the policy, allowing interest on the balance till exhausted. One American Company guarantees to allow interest on the balance at *not less than 3 per cent.* At the present time I believe it allows 4 per cent., retaining the balance of interest earned—something less than one-half per cent.—for expenses. At death of the beneficiary the balance is paid to the legal representatives, or sometimes to a second nominee till exhausted.

An Australian Society offers to act as trustee in a somewhat similar manner, if requested to do so, a rate of interest being allowed 1 per cent. below the effective rate earned for the year on the mean funds of the Society, the capital being returned intact.

Guaranteed Dividend Policy.

This is a without-profit policy, the difference between the with-profit and without-profit rate being applied to purchase an additional pure endowment payable at the end of the term.

3 per cent. Income Policy.

One large American Company has lately issued a form of 20-year endowment insurance, under which the premiums are slightly over £50 per £1000, and 3 per cent. of the total premiums to date is payable to the assured every year in addition to the insurance of £1000 at death within the term. If preferred, the interest may be allowed to accumulate at $3\frac{1}{2}$ per cent. to the end of the term, when several options are allowed.

A Scottish office also issues a similar form of policy, which is

limited, however, to single premiums. For a single premium of £1000 an immediate annuity of £29 11s. is payable for life, while the capital originally invested is returned at death together with the bonus accumulations.

Double-Endowment Insurance.

The double-endowment insurance is a rather curious policy, consisting of a term insurance for £100 combined with an endowment for £200 payable at the end of the term. The peculiarity consists in the fact that, within wide limits, the premium does not increase with the age of the proposer, varying only with the term of the policy. The amount of pure endowment which can be combined with a term insurance for £100 may be made to vary greatly; if the endowment be for £100 only the result is an ordinary endowment insurance, while the endowment *might* be for, say, £1000, when the insurance element would be comparatively trifling. Many years ago the coincidence was noted that if the endowment is made twice as large as the insurance the premiums remain practically constant regardless of the age; this form of policy was, I believe, first adopted in practice by Dr. Pierson, the actuary of an American Company, about 1882, and has since been adopted by many other offices. The strictness of the medical examination may be considerably relaxed, but it is necessary to take precautions to exclude absolutely uninsurable cases, because if an extreme rate of mortality prevailed the term insurance premium would exceed the rate for the combined benefit in normal circumstances. The policy is undoubtedly useful in certain cases when the life would otherwise be rated up, but its use requires care and a knowledge of the effect of variations in the incidence of extra mortality. The age at maturity is generally limited to 70.

One variation of this policy is to give an endowment insurance for £100 in addition to a return of 2 per cent. per annum of the sum assured at maturity. Another is to combine a whole-life insurance for £100 with an endowment for £100; while a third variation is to give £100 endowment insurance with return of premiums at death during the term, and a paid-up policy for £100 with deferred bonuses at the end of the term.

A similar form of policy, entitled a guaranteed tontine benefit policy, secures £100 at death before a given age, and at maturity a return of the premiums, which are very heavy, accumulated at 3

per cent. compound interest, the endowment being always considerably more than double the insurance.

In connection with this policy, I may say that I consider it objectionable and misleading to describe the pure endowment as a "guaranteed bonus," which is sometimes done.

Half-Endowment Insurance.

It is convenient to refer here briefly to a policy which is sometimes offered (although it would perhaps come more properly in the former division); it is framed on the exactly opposite principle from the policy last described, the term insurance for £100 being combined with an endowment for £50 only.

Increasing Insurance.

A Japanese office issues a whole-life policy for an original sum assured of 110 yen, the insurance being increased every year by 10 yen until death; or the policy may be for 130 yen with yearly increments of 30 yen; or for 150 and 50 yen, or 200 and 100 yen. An American Company offers what I consider an attractive policy of this kind, which is called a guaranteed 5 per cent. 20-year endowment bond. The original sum assured of £1000 is increased by £50 every year, so that after one year £1050 would be paid at death, after 10 years £1500, and at the end of the term £2000. Here again it is objectionable to call the additions "guaranteed bonuses," especially if, as is sometimes the case, they are deferred until the end of the term, in which case the contract is merely a double-endowment insurance.

Pension Insurance.

A pension insurance consists of an insurance combined with a deferred annuity. The following are varieties in existence:—

1. A temporary insurance for £110 until 60, when the options are given of £110 cash and a life annuity of £10.

2. A temporary insurance for £100 till any age from 50 to 65, after which a life annuity of £10.

3. A whole-life insurance for £100 with deferred annuity of £6, £13, or £15 after 65.

4. A whole-life insurance for £300 with an annuity of £100 after any age from 58 to 70.

5. A temporary insurance for £300 at death within five years after any age from 50 to 70, with an annuity of £100 for five years after the age selected.

Reversible Premium Insurance. This is a whole-life insurance for £100, the premiums ceasing at 60 or 65, one premium being returned every year after the age selected until death, when the sum assured is payable with profits.

In France a similar policy is in vogue, called an "assurance combinée," the option being allowed of receiving a fixed sum in cash at the selected age.

Return-Premium Policy. This is a policy containing a provision that all the premiums paid shall be returned with the sum assured at death within a certain term or at any time.

Tontine Insurance. Space forbids my going into the history of tontine insurance, nor is it necessary, seeing that the system has been gradually stripped of most of its objectionable features and has now come down to ordinary insurance in which the bonuses are accumulated for the benefit of the survivors. So long as misleading estimates, based on past experience in the face of a falling rate of interest, are not used, there is nothing to object to in the bonuses being deferred in this way, though it is to be feared that the public do not always understand exactly what they are going in for. It is a very common practice, especially with American offices, to tontine the profits, either till death or for a shorter term, and nearly all offices, however they may profess to detest the system, apply the tontine principle in some slight degree in their ordinary treatment of surrender values and the vesting of bonuses.

Before leaving the two main divisions of the subject, I may mention that it has been proved beyond doubt that, in Great Britain at all events, the rate of mortality varies with the class of insurance, the general principle being that the higher the rate of premium the lower the rate of mortality, from which it may be inferred that the selection exercised against an office by a proposer is greater than has been supposed. Low-premium policies also generally show a higher lapse-rate, and also cause more loss or less profit at lapse, than high-premium policies. It does not, however, follow that an office should restrict itself to forms of insurance carrying high premiums.

CHILDREN'S INSURANCE.

Endowment. In its simplest form this consists of an endowment payable on survival to, say, age 21, either with or without return of premiums at previous death. It is often arranged, however, that the premiums shall cease in the event of the death of the person entering into the transaction who is subject to a medical examination. It is the practice in France to issue a policy called an "assurance à terme fixe," under which the sum assured is payable on a fixed date, whether the insured is alive or not, the premiums ceasing at his death should it happen before that date. It is considered to be preferable in some respects to the ordinary endowment, as, in the event of the death of, say, the eldest son, the amount still remains as a provision for the younger children.

Educational Annuities. These are simply deferred annuities running for, say, five years after age 11, 16, 18, or 21.

Deferred Insurance. A feature provided to meet the desire of parents to encourage their children to avail themselves of the benefits of life insurance takes the form of a deferred insurance commencing generally at age 21. A great advantage of this policy is that no medical examination of the child is necessary. The premiums are returnable, either with or without interest, at death of the child before 21, and it may be arranged that the policy shall become paid-up in the event of the purchaser's death during the interval. Bonuses are allotted after age 21, when it is not unusual to allow the option of receiving an endowment in cash or continuing the policy as a whole-life or endowment insurance according to the Table chosen.

Although I believe this policy has not yet been greatly sought after, it has many advantages, and should prove of valuable assistance to agents and offices in this Colony, where, out of a total white population of about 770,000, over 250,000 are under the age of 15.

ANNUITIES.

Immediate Annuities. Annuity business has increased largely in recent years. In 1891 offices operating in the United Kingdom had immediate annuities on their books upon which £855,000 per annum was payable, while in 1901 this had increased to £1,682,000 per annum.

In these Colonies the amount rose from £22,800 to £61,100 per annum in the same period. The increase is no doubt largely due to the increasing difficulty experienced in finding profitable and safe investments, consequent on the fall in the rate of interest.

Deferred Annuities.

Deferred annuities, on the other hand, have never been, and I am afraid never will be, a popular form of providing for oneself in old age, although many well-informed people seem to think that a life insurance office has simply to place tables of deferred annuities before the public when a boom in voluntary thrift will eventuate. What actually takes place is shown by the experience of an office which was founded about a third of a century back. Those responsible for its existence were sanguine enough to expect the office to do a big business in deferred annuities, and the first prospectus devoted 44, out of a total of 63, pages to that form of policy. Result: 16 deferred annuities (and 84,000 other polices) were issued to the public in 33 years. The prospectus of that office now contains no reference to deferred annuities.

It has sometimes been argued that, as an office gives less favourable terms to a proposer for his life insurance when his life is under average, more favourable terms should be allowed him when purchasing an annuity. I do not agree that the suggested practice would be a desirable one to follow, owing to the difficulty of discriminating (among other reasons), but I believe it has recently been adopted in the old country.

MISCELLANEOUS VARIETIES.

Monthly Premium Policies.

It would be out of place in this paper to deal with Industrial Insurance, but I may point out that certain British Ordinary Offices are now endeavouring to supply a convenient form of Ordinary insurance to the classes which have hitherto been catered for principally by the Industrial Companies. These offices issue policies on which the premiums are payable monthly. It seems usual to stipulate that the premiums must be some multiple of 1s., and no smaller premium than 5s. is accepted, nor are policies granted for less than £50. Renewal premiums are made to fall due on the first day of the month.

Insurance Without Medical ·amination.

This system is at present practised by a few leading offices in Great Britain, usually in one of the following forms :—

1. Under a double-endowment insurance.
2. An extra premium of £1 per cent. is charged for the first year, and 10s. per cent. for the second year, after which the ordinary premium is payable.
3. The ordinary premium is charged, but only one-third of the sum assured is payable at death in the first year, and two-thirds at death in the second year, after which the full sum assured is payable.

It is usual to require a special statement as to habits, health, family history, &c., and to reserve the right to communicate with the proposer's ordinary medical attendant. An office which adopts the double endowment system keeps separate accounts for this class and reserves the profits for those policies on which two-thirds of the premiums have been paid, when bonuses are allotted in the form of temporary insurances.

The system evidently requires to be applied with the greatest caution, and even then I am disposed to think that the public might be inclined to look with some suspicion on an office practising it.

Term Insurance. Insurance for short terms affords temporary protection against death, and is generally required as collateral security in financial transactions.

Joint-Life Insurance. The sum assured is payable on the death of the first of two or more lives, and enables a firm to pay out the representatives of a deceased partner without impairing the working capital.

Contingent-Survivorship Insurance. In return for a premium payable during the joint lives, the sum assured is payable at death of "A" if "B" be then alive. The policy may be found useful to those who wish to provide for relatives or dependants in the event of the latter surviving, but it is generally effected when a person is entitled to property in the event of his surviving another, in order to enable him to absolutely secure the reversion and thus convert it into a reliable security.

Last-Survivor Insurance. The annual premium is payable until the death of the last survivor, when the sum assured becomes due. This policy is usually taken out to replace capital or pay fines where it is the practice, as in certain districts of England and Ireland, to grant leases dependant on two or more lives. Such a policy enables the

lessee, at a small annual cost, to insure against the loss which would otherwise be caused by the death of his nominees.

Issue Insurance.

This is a form of insurance often required in the old country to insure the payment of a sum of money on the birth of issue in connection with certain kinds of reversionary transactions.

Life Insurance with Loans on Mortgage.

Under this scheme a loan, repayable by instalments, is granted on the security of freehold property, with the provision that, in the event of a borrower's death before the repayments are completed, the balance of the debt shall be cancelled and the ordinary expenses of the mortgage met by the Company.

Life Insurance with Health, or Accident, Insurance.

For an increase of about five per cent. to the ordinary premiums, a provision is added to the policy exempting from payment of premiums under circumstances involving temporary or permanent incapacity, caused either by accident or bodily or mental disease. It is generally limited to first-class lives between 25 and 60, and to occupations involving no special risk. An Australian office has lately introduced a contract combining the ordinary personal accident benefits with the usual life insurance benefits, and we are given to understand that a considerable amount of success has been attained. Nevertheless, I am inclined to think that it is better to adhere to the older practice of giving separate contracts for life and accident insurance.

Having now dealt with all the varieties of life insurance of whose existence I am aware it is just as well that I should finish, or you may be anticipating combinations of Life with Burglary and Plate-glass insurance.

I have now completed my task to the best of my ability, although I am conscious that my treatment of the subject has been very imperfect. I would acknowledge my indebtedness to the writers of numerous valuable essays and papers presented to the Institute of Actuaries and provincial insurance institutes, a study of which has been of great assistance. I have also obtained much help from the Board of Trade Returns and the prospectuses of life offices throughout the world.

I need hardly say that I do not approve of all the forms of

insurance described in this paper; indeed I regard some of them with much disapproval. On the other hand, some are worthy of earnest consideration, and any office which does not wish to fall into the background, outdistanced by its more active competitors, should, in justice to its agents and in its own interests, offer to the public from time to time a few well-considered schemes embodying something likely to prove attractive. As in other kinds of business, it is not always possible to judge the taste of the public accurately beforehand nor to foresee what will take on and what will not, but the use of policies which prove to be unattractive can easily be discontinued at any time, while those which *do* meet a want may be the means of largely benefiting all concerned; nothing but actual experience can prove this. Moreover, an occasional variation of old methods will stimulate the activity of agents and smarten up their programmes, thus affording them valuable aid in prosecuting their arduous labours. I believe they find that something new, although it may not be in great demand, often enables them to introduce the more ordinary plans of insurance with greater success than they would otherwise be able to do. But the foremost consideration in dealing with these matters should always be to see that no form of policy is adopted that is not absolutely clear and above-board; every contract should have its benefits plainly set forth and clearly defined, and above all there should be no ambiguity or dependance on estimates which are liable to mislead the public.

In thanking you for your indulgent attention I venture to hope that my humble effort may lead to a discussion upon the merits and demerits of the most prominent varieties of life insurance that will interest and benefit the members of the Institute.

METHODS OF DEALING WITH UNDER-AVERAGE LIVES.

By T. B. MACAULAY, F.I.A.

A Paper read before the Insurance Institute of Montreal, 28th November, 1901.

I AM afraid that many of my hearers have the idea that actuarial questions must of necessity be dry and uninteresting. The very name brings to them visions of mathematical formulæ and of never-ending statistics. When searching for a subject which would be free if possible from this condemnation, it occurred to me that I probably could not do better than take up one department which has already had an attraction for myself, and in which the duties of the actuary touch the field officer very closely, namely, the methods of dealing with risks that are considered to be scarcely up to the standard. It is the duty of the chief medical officer to pass on the merits of the individual lives which come before him, and I have no desire to enroach on that province. Now, however, that the practice has become so common of assuring under-average or sub-standard lives, it becomes necessary that the actuary be consulted as to the nature of the special terms which are to be imposed on such lives. Not merely should this be done with regard to sub-standard cases considered as a whole, but also, I think, with regard to the various broad groups or classes into which that whole can be divided with more or less accuracy. Each such group has its own characteristic mortality curve, and should receive separate consideration.

Of the several methods of dealing with such cases, the principal are the following:—

(1) Policies are written on a plan of assurance calling for a higher premium that that applied for in the proposal. For example, a person who desires a policy on the whole life plan is

sometimes granted one on the ten, fifteen, or twenty year endowment plan.

(2) Applicants are rated up by the addition of a certain number of years to the real age. For example, a person aged thirty-five is loaded five, ten, or even more years, and required to pay the premium corresponding to that increased age.

(3) Policies are issued calling for premiums based on the impaired life table of the Institute of Actuaries' experience (the D^{MF}).

(4) Policies are written at the regular premiums, but with a proviso, usually in the form of an indorsement, that in case of death within a specified term of years a deduction shall be made from the sum assured. This deduction or lien is usually a decreasing amount, but is occasionally uniform for a term of years.

(5) Policies are issued at ordinary rates, but placed in classes by themselves, so that any excess in the mortality experienced may be deducted from the profits of that special group.

At first glance it might be supposed that these varying systems are contradictory, and that if one be right the other must necessarily be wrong. Further acquaintance with the subject is likely to modify this conclusion somewhat. We cannot but have our personal opinions as to which method possesses the greatest merit, but even the most zealous advocate of a single system has to admit that no one of those mentioned, his own favourite included, is applicable to every form of impairment. It is equally true that there are very few of those named which are not peculiarly applicable to certain conditions.

I will endeavour to give in the few minutes at my disposal a synopsis of the strong and weak points of each of the methods above enumerated.

The practice of changing the plan of assurance from that applied for to an endowment or other table calling for a higher premium, is common among American companies. It is hardly, I think, to be considered a safe and proper way of dealing with cases in which a decided impairment exists. If, for example, a predisposition towards comsumption be feared, either from the family history or the applicant's own light weight or lack of robustness, how does a change to the twenty-year endowment plan protect the company against the extra mortality which is likely to be experienced? The premiums charged are no higher than those for healthy lives, and an abnormally heavy death rate involves

loss to the company, no matter what the plan of assurance may be. The only effect of the change is to reduce that loss by an amount equal to the difference between the reserve on the endowment plan and the amount which would have been the reserve had the policy been issued as applied for. It is sometimes thoughtlessly supposed by agents that the increase in the premium, which results from the change of plan, will compensate the company for carrying a bad life. In other words, this difference is looked upon as an extra which is added by the company because of the impairment, and as corresponding to the extra usually added for hazardous occupation. This is an entirely erroneous view. Real extra premiums are payments made for the purpose of meeting the excessive mortality expected, and for which the company gives no other consideration. When policies are changed to endowment assurances, the larger premiums do not provide for extra mortality, but merely purchase additional benefits for the advantage of those who survive the endowment terms.

But while this method of treating under-average lives is unsuitable in most cases, there are yet some instances in which it can be properly employed. If, for example, an applicant twenty-five or thirty years of age is himself in every way a robust and desirable life, but has a record showing that his family have a tendency to drop off from one cause or another at from sixty to sixty-five years of age, it would possibly be safe and fair to issue him a twenty-year endowment policy on ordinary terms, since in that way the amount at risk would be lessened with every passing year, and would cease entirely before the dangerous ages. The same argument would apply to a large extent to persons who have suffered from diseases like syphilis, which have a tendency to recur later in life.

But decidedly the most numerous and important class of cases to which this method can wisely be applied is that in which a slight doubt exists as to the moral hazard. By proposing an assurance at a higher premium, with benefits which will only mature if the life survives a term of years, a test is made of the good faith of an applicant. The difficulty is to distinguish the good from the bad, and I believe that the winnowing which this method effects is probably as satisfactory as any that could be employed. Some really excellent lives will, of course, refuse to agree to the alteration, and a certain amount of desirable business will thus be lost. I am convinced, however, that in the great majority of

doubtful cases (as, for example, where the applicants insist upon a suspiciously large amount of assurance for a cheap plan, with possibly other doubtful features), the companies will find it to their advantage to let those pass that will not accept policies on more favourable plans. I believe that more profit will be made out of the smaller business which will thus be put upon the books than out of the larger volume which would have been done if no change in the plans had been made.

How closely this question of moral hazaad or adverse selection is connected with the plans of assurance may be seen from the fact that the mortality on endowment and tontine assurances is almost universally found to be very favourable; that on limited payment life policies to be less favourable than that on endowments, but superior to that on ordinary whole life assurances; and that on term policies to be decidedly the worst of all. Non-participating policies, also, exhibit a much heavier mortality than those which participate in profits. It is evident, therefore, that this method of dealing with doubtful cases has an important place in life assurance practice.

The second method, that of adding a number of years to the real age, has been in use for a long period. Outside of this Continent it is practically the only method employed. In Great Britain and Australia it is so deeply entrenched that all other methods are usually tested by it. In America, however, it is almost unknown outside of actuarial circles. Such slight attempts as have been made to introduce it have not had encouraging results. The objection which every man naturally has to paying any higher premium than his neighbours of the same age, and the unwillingness to admit that he is inferior even as regards health, renders it very difficult for an agent to place a policy thus loaded. Rival agents are, moreover, always on hand to convince the individual that if he will only give a proposal to their company he will be accepted without the "unjust imposition." Few but those whose lives are decidedly impaired finally agree to pay the extra premium. Even if the policy be at last placed, the assured labours under a sense of fancied wrong, and is ready to drop his policy at the first opportunity of getting better terms. The lapses among such policies are apt to be heavy, except where the lives have deteriorated in health; in such cases they are few. If health improves, the policy-holders usually ask that the extra be removed, or they withdraw. The company is likely, therefore

so far as the little experience in this country is a guide, to remain saddled with the bad cases and to have but a short experience with the good ones. The system appears to work fairly well in countries where the public have been educated up to it, but I would hardly recommend it for Canada or the United States.

In another respect, also, this system is open to criticism. It assumes that if persons, whose real age is 30, be accepted with a loading of ten years, or at age 40, the future mortality curve among these individuals will correspond to that among healthy persons whose real age is 40. This assumption can hardly be justified. Even if the net premium actually required for the group be the same as that for healthy persons aged 40, it will be found that the mortality among the impaired lives will be heavier than among the healthy ones in the earlier years of the assurance, and lighter during the later years. Although persons may have been loaded ten years because of a family history of consumption, some certainly of them (if the group be large enough) will survive to sixty or seventy years of age, and the chance which these will then have of living to the very limit of the mortality table will probably not be much less than that of persons of the same age with no consumption in their families. This method of loading assumes that the last of the loaded cases must die ten years short of the limit of the mortality table, which, of course, will not be the case. Mr. A. H. Bailey has stated that his company once paid a claim on a sea captain whose age at death was but a few months short of 100. If the loading for his occupation had been computed in years, it would have had to be assumed that he had reached what would correspond to age 120 among healthy persons whose occupation was not hazardous!

It may be replied that the real question is not whether the mortality among the impaired lives will follow the exact curve of healthy lives of the age to which the others have been rated up, but whether the total extras charged by this system of loading are sufficient on the whole to cover the extra mortality which will be experienced. I admit at once that there is some force in this statement of the case. As a general principle the fact, however, remains that the method of age loadings does not provide as heavy extras as are really required in the early years of assurance, and provides heavier than are required in old age. Even if we look on the increase in the premium as a mere fixed annual extra, we must not forget that there are but few forms of

impairment that call for a uniform extra throughout life. The abnormally heavy mortality among any group of impaired lives usually occurs in the earlier years of assurance. Of course there are causes of loading that attain their greatest importance in advanced life, as, for example, heart disease and gout, but these are the exceptions. In most instances what a company requires is protection against an excess of deaths during the decade or two following the issues of the policies, and in this respect the method we are discussing is not satisfactory. It is true that if the extra premiums received in the early years of the assurance be insufficient to provide for the extra mortality actually experienced, that deficiency may be made good by the overpayments later in life, but the company would have a long time to wait in order to come out even, and it has no assurance that the policies will be kept in force. This is a risk which an institution can hardly afford to run.

Another result which follows from the fallacious assumption that the mortality among rated up lives will agree with that among healthy lives of the rated up age, is that the premiums thus brought out for endowment assurances are entirely too low. If a young man be loaded ten years because of a consumptive tendency, the extra premium on the whole life plan will amount to several dollars per thousand, while, if the same number of years be added on a short endowment plan, the extra will be but a few cents. The actual extra mortality in most forms of impairment may reasonably be expected to fall chiefly within the endowment term, while by the age loading system it is assumed that it will fall largely after the maturity of the policy and that the company will thus escape most of it, while as an actual fact it will not.

Before closing the discussion of this method, I must, as a simple act of justice, emphasise the fact that those British and other offices which use this system have been the pioneers in the assurance of under-average lives, and that in their hands this method has, as a whole, proved a success. I have nothing but praise and admiration for the companies and actuaries who have opened up this line of business, which we on this side of the Atlantic have left almost untouched until within recent years. It is the success of our British friends that has emboldened Canadian and American actuaries to follow in their footsteps. This, however, need not blind our eyes to any defects in their machinery or methods, nor prevent us from adopting what we believe to be improvements.

Coming now to the third of the methods enumerated, we notice that it assumes that the mortality among the under-average lives assured in any particular company will agree with the united experience of the twenty English offices. This is a dangerous assumption. It would be strange, indeed, if all companies were to have exactly the same proportions of the various kinds of risks on their books. Apart from the influence of agency connections and of chance, the mortality which any one company will experience will depend upon the width to which it opens its own doors, and we have no means of knowing whether the practice of any individual company agrees with the averages of the united offices. Moreover, the principle of putting all classes of under-average lives into one grand group is indefensible. Success can only be attained as a result of the most careful discrimination by the medical department between the different degrees of impairment. To charge the same extra on a life the only flaw in connection with which is perhaps a single death from consumption in the family record, as on another where both parents have died of consumption, or where the applicant has had spitting of blood, is unjust, and can only result in attracting the poorest class of business. I know of but one company that has followed this system, and it has, I believe, very wisely abandoned it.

We now come to the fourth of the methods, that of writing policies at regular rates, but subject to liens or debts which are to be deducted in case of premature death. I confess that this is my own favourite plan. I do not claim that even it is applicable to every case, but I do think that it is subject to fewer objections than any of the others. The method was originated by the late Mr. Morrice A. Black, in 1861. Mr. Black at that time resided in England, but he subsequently removed to Australia, where he became the actuary of the Australian Mutual Provident Society. It is rather odd that this method has been only very moderately popular in either England, the land of its birth, or in Australia, but that in one form or another it is rapidly spreading on this Continent, and is already the most common method here of dealing with sub-standard cases. Perhaps I may be pardoned for pointing out that the company with which I have the honour to be connected was the first, and for a while the only one in Canada or the United States, to adopt this system, and may, therefore, I think, fairly claim to have been the means by which the system has been introduced to North America, where the indications are that it

will reach by far its greatest development. The manner in which it has been adopted by company after company, including many of the largest and most conservative, is strong testimony to its value.

The problem which the actuary has to solve is not merely that of protecting the company against excessive mortality, but that of doing so in such a way as to facilitate the work of the agent. We have seen that an addition to the premium is usually resented by the applicant, and that it is difficult for an agent to place a policy thus written. When, however, the extra premium takes the form of a lien, to be deducted from the sum assured only in case of early death, I think the sugar-coating has been made about as complete as it can well be. The agent is enabled to point out that no addition has been made to the annual premium, and that the life will be assured on precisely the same terms as any other person of his own age, with the sole exception that, if he dies within a certain number of years, a deduction will be made from the amount of the policy. Here it is possible to appeal to the applicant's confidence in himself, which is the very characteristic which makes him unwilling to accept a policy with an extra premium of the usual kind. The agent can say—"You believe that you are "a first-class life, and that although your record is perhaps not all "that we could wish, you will not be affected by it. The company "offers you a contract by which the future is allowed to decide "whether you or the medical referee are correct. If you live out "the next twenty years, no deduction of any sort will be made. "Moreover, with every year that you live the amount to be "deducted will be reduced. If, on the other hand, you die early, "that will be *prima facie* evidence that the company's judgment "was correct; but even in that event your family will find the "assurance the best investment that you ever made." Of course, the fact of a man's surviving does not conclusively prove that he was a good life, nor does his premature death prove that he was a poor one, but there is a large kernel of truth in this view of the matter.

A striking feature in connection with liened policies is that after they have been put in force there is not experienced among them the heavy lapse rate which has been found to prevail among those on which extras have been added to the premiums. In fact the lapse ratio among these policies has in at least one case been actually less than among those which have been accepted on ordinary terms.

Policy-holders are as a rule comparatively well satisfied because their cash premiums have not been increased and the amounts of their contingent debts are being automatically reduced. The fact that a person accepts a liened policy indicates that he has considerable confidence in himself, and that the company is, therefore, protected against adverse selection at the initiation of the assurance. The low lapse ratio then ensures against the possibility of the mortality being unduly swelled by the subsequent withdrawal of the best lives, which is such a danger in connection with policies which call for an increase in the premium. A company is likely, therefore, to have a much better mortality under this method than would be the case if the method of age loadings were followed.

I may here interject that, when a policy has once been issued and accepted subject to a lien, it is not fair to the company to allow that lien to be reduced in future years if the assured should improve in health. Should the life deteriorate, or should an error of judgment have been made, the company has no power to increase the amount of lien, and it cannot, therefore, be expected to make a reduction in cases which work in its favour. A strict rule on this subject should be laid down. If such a rule be firmly adhered to, the requests for reconsideration of old liens will not be numerous.

In practice, one of the difficulties which a company continually meets is the assertion of an applicant that while he is perfectly willing to accept the lien proposed if it be limited to death from consumption or from whatever other disease may be the one most feared in his case, he objects to a deduction being made because of death from any cause. The answer to this is that if the lien were to apply to only one cause of death it would have to be very large indeed—in fact almost equal to the sum assured. Furthermore, it would be very difficult in many instances to distinguish between causes of death, especially in chronic cases. Tuberculosis may take the form not merely of consumption, but of several other diseases, and frequently there is a complication of troubles, which would be very apt to provide grounds for litigation. Moreover, a general weakness of constitution predisposes not merely to one disease but to many. Some companies, in their effort to assist their agents by making their policies attractive, have excluded death from purely accidental causes. This is as far as an office can safely go. The amounts of the liens require, of course, to be slightly increased as a result of this restriction.

I have already referred to the fact that the extra mortality on most classes of under-average lives occurs chiefly in the earlier years of the assurance. I could produce statistics in support of this assertion, but will not weary you with them. I desire, however, to point out that the contingent debt system adapts itself to this peculiarity of the mortality curve. During the very period of life when the extra mortality is likely to be at its maximum, the liens which are to be deducted from the death claims are also at their maximum, and when the policies have been, say, twenty years in force, and have to a large extent passed beyond the dangerous stage, and when the reserve has increased until it forms a considerable proportion of the sum assured, the lien disappears. It would appear, therefore, that this system has the advantage of adapting itself to the mortality curve in a way that no other does. It is peculiarly applicable to those cases where the loading is on account of a consumptive family record, light weight, lack of robustness, or any other blemish which would lead us to expect an extra mortality greater in youth than in old age. Where the weak point is of a different character, as, for example, heart disease, gout, repeated attacks of rheumatism, previous bad habits or overweight, which would lead us to expect an extra mortality permanent throughout life, or even increasing with age, the difficulty can usually be met by combining the lien system with a change of the plan of assurance to an endowment of a term varying according to the circumstances. If, for example, the assurance be placed upon the twenty-year endowment plan, with a lien which will diminish by one-twentieth of the initial amount per annum, the company will be protected, not only during the early years of the assurance, but during the later, for the gradual increase in the reserve will more than offset the reduction in the amount of the lien, and the amount of risk will therefore steadily decrease, while the dangers of old age itself will be evaded entirely by the maturing of the policy. It may be said that in cases where the mortality to be feared occurs only in old age, the lien system is inapplicable, and I admit that this is so. On the other hand, such cases are rare, and, speaking generally, if we are justified in expecting a heavy mortality in advanced life, we are usually justified in expecting a somewhat heavy mortality in earlier life also.

In striking contrast to the systems of age loadings by which the extra premiums to be collected are spread over the whole of

life, the liens or extra premiums under the contingent debt system are all paid during the early years of the assurances. The company runs no risk of losing its extras by the lapsing of the policies of those who survive. The liens operate during the period when the largest proportion of the assurances are still in force. By the system of age loadings, a company may lose the extras payable in old age on which it is relying to make good the excessive losses in youth, but this cannot happen under the contingent debt system. Incidentally I may point out that it is necessary, or at least desirable, that the lien term shall extend over the whole period during which an excessive mortality is expected.

If the objections which have been set forth to the system of age loading be accepted, it follows that that system is not a proper basis on which to calculate the amount of the contingent debts which should be imposed upon any policy. Even if the extra cash premiums required by the age loadings be correct, viewing each policy as a whole from its inception to its finish, it is yet true, as already pointed out, that that extra mortality is improperly distributed. As the amount of liens which a company will collect on any group of lives depends entirely upon the number of deaths which will occur during the currency of the lien terms, or in other words, during the early years of the policies, it follows that any system which underestimates the number of deaths in those early years also underestimates the amount of the liens which will be collected in connection with such death claims, and will therefore result in heavier liens being calculated as required than those which are really required. I think, therefore, that all connection between the age loading system and the lien system should be abolished. To retain such a connection is only to mislead ourselves. The lien system requires no propping from the other, and is in fact much better able to walk by itself than as an appendage to any other system. The question may be asked—If you do away with the system of age loadings, how are you to calculate the amount of the liens which should be imposed? The answer is simple. The number of years of loading imposed on any life is arbitrarily fixed by the chief medical officer. The doctor's decision is no more open to criticism, so far as I can see, if it take the form of an arbitrary percentage of the sum assured (for example, thirty, forty, fifty, or sixty per cent.) than if it take the form of an arbitrary addition

of a number of years to the age. It is in fact much easier to estimate with comparative accuracy what percentage of the sum assured the debt should form than it is to estimate how many years should be added to the age.

Another feature of the lien system is that it is to a certain extent elastic. It lessens the danger from errors of judgment. If a company's medical officer should by chance be too lenient upon any group of lives, and the mortality prove heavier than anticipated, that very fact will increase the number of liens which the company will collect, and, although this will not entirely offset the loss to the company, it will reduce it.

A peculiar modification of the lien system has been adopted to a small extent in some parts of the United States. It consists in the imposition of a contingent debt, which, however, is in all cases equal to the amount of the single premium for the age of the applicant; which debt is improved at interest, but annually diminished by the amount of yearly premium paid. Just what can be said in favour of this system, from the standpoint of scientific accuracy, I at present do not see.

It is surprising to find the statement made by both English and Australian authorities that the contingent debt system has not proved popular with them. We are told, for example, that in New Zealand the Government Insurance Department was formerly in the habit of giving three options—first, the addition of an extra premium corresponding to the increase in age; second, the deduction of an unvarying amount in case of death within the term of the expectation of life; and third, a decreasing debt to be deducted in case of death during the same term. We are informed that the great majority of applicants preferred to pay the cash extra; that of the minority most preferred the unvarying liens, and but few chose the reducing liens, the initial amounts of which were necessarily larger than the others. At first blush it is difficult to account for an experience so different from what we would expect. I think, however, that the explanation is to be found in several circumstances. In the first place, the public, both in England and in Australia, are to a certain extent educated to the system of age loadings. More important than this, however, is the fact that simplicity is essential to popularity. Both the English and the Australian companies took, we understand, as the basis for their quotations, the addition of a number of years to the age, and then figured out an amount, usually a

very broken sum, which was to be deducted in case of death during an odd number of years. For reasons already explained, the liens brought out in this way were of necessity erroneously heavy, and were, therefore, not so likely to be accepted. With more equitable liens and greater simplicity, I am inclined to think that the results would have been very different.

Our own company for some time after introducing the system gave the alternative of an extra cash premium corresponding to an age loading. We soon decided, however, that it was unwise to give such an option, partly because of the complications and lack of simplicity which it forced upon us, but chiefly because of a deeply-rooted opinion that those persons who objected to the lien and preferred the extra cash premium were not as desirable risks as the others. Our conviction as to the superiority of the mortality which we would experience under the lien system, as compared with that which we could properly expect under the system of additions to the age, was so strong that we concluded that to allow the option of a cash extra at all was to open the door to discrimination against the company. That was our opinion many years ago, and the lapse of time has but strengthened it.

The fifth and last of the methods mentioned at the beginning of this paper is that of issuing policies at ordinary rates, but placing them in a group or groups by themselves, so that the excessive mortality, if any, may be deducted from the profits of the particular group in question. There is something to be said in favour of this practice. It, however, must be limited strictly to classes in which the impairment is but trifling, for the maximum extra premium which the company can collect is the amount of profits contributed by the policies. I fear, moreover, that agents do not always lead applicants to expect any diminution in the surplus which they will receive, and the dissatisfaction which would result if large reductions were made would be very great. It may be doubted whether any company will have the courage to incur the odium of making any sweeping reduction in the profits of policy-holders in such classes. In that event the usefulness of this particular method is very limited.

And now I have done. Perhaps the question may be raised whether the introduction during recent years of such systems as we have been discussing has been really beneficial or not. Personally I think that the innovations have worked to the

advantage of both policy-holders and agents. Apart from the fact that it is the duty of Life companies to extend the blessings of assurance to as large a number as possible, and in particular to those who are not assurable as first class lives, I believe that the opening of a third course to our medical officers, by which they can accept on special terms those who would otherwise be on the dividing line between the good and the bad, some being accepted and some rejected, makes for better selection and more favourable mortality, and, therefore, for the advantage of the great body of policy-holders. On the other hand, while agents certainly lose some cases by failure to place loaded policies which the companies would formerly have accepted on ordinary terms, that loss is, I believe, more than made up by the acceptance by the companies on those special terms of cases which would formerly have been declined. I think, therefore, that the new methods benefit all concerned.

VARNISH WORKS.

By J. HEADON BOOCOCK.

A Paper read before the Birmingham Insurance Institute, 17th February, 1905.

I HAVE the pleasure to appear before you to-night in order to place under your consideration a few notes on varnish-making. I must ask for your kind indulgence at the commencement, if you are expecting anything at all special, as, I am bound to say, the subject is a rather *thin* one, as it does not lend itself to any description of intricate processes or special machinery. In fact, almost anyone could set up as a varnish manufacturer; he only wants a few vertical pans, with a coke fire underneath, and the mixture of a few suitable ingredients to make varnish; but the practical manufacturer would smile at this remark, and he would assure you it requires practically a life-long study and the use of secret recipes, together with a properly-equipped laboratory, in which experiments have to be made and constant analyses and tests of the manufactured material carried out to secure that good name which goes so far to sell the product to manufacturers and others who rely upon the quality of the varnish supplied to assist them in turning out good work to their customers.

The varnish trade is peculiar in this respect, that it requires a considerable amount of capital, as after the varnish is made it has, so far as the finest quality is concerned, to be kept, like whisky, until it is fully matured. Some kinds of varnish have to be kept in stock for years before they are ready to be placed on the market; therefore the older and wealthier firms have really a monopoly of certain qualities, as younger and less wealthy competitors are necessarily compelled, by their limited means, to manufacture only the commoner kinds for immediate consumption.

The definition of varnish is "a fluid preparation which, when spread out in thin layers, dries either by evaporation or by chemical action into a hard, transparent, and glossy film."

Varnish is used to communicate lustre and brilliance to many different kinds of dressed surfaces in metals, wood, leather, &c., and to protect them from the influence of air and damp. The chief requisites are that it forms a fairly adherent layer on the surface, and dries hard, yet with sufficient elasticity not to crack with changes of temperature.

In this district it is used principally for what we call japanning. It is of interest to note that this term originates, as its name implies, in Japan, where the art of lacquering (to which we shall allude later on) had its rise, japanning being really an imitation of lacquer applied to metallic substances.

Now, the varnish used for japanning is manufactured from the basis of pitch, linseed oil, petroleum, and turpentine, and is known as black varnish. This is what we see in the dipping-troughs or in the vessels used in bedstead works for coating bedsteads before they are placed in the drying-stoves.

Of quite recent years Government has taken the storage of black varnish for japanning under its supervision, owing to its having been decided that the storage of any material into which petroleum enters comes under the Petroleum Act of 1871.

Under that Act the term Petroleum is defined as including any rock oil, Rangoon oil, Burmah oil, oil made from petroleum, coal, schist, shale, peat, or other bituminous substance, and any products of petroleum, or any of the above-mentioned oils; and the term "Petroleum," to which this Act applies, "means such of the petroleum so defined as, when tested in manner set forth in Schedule 1 to this Act, gives off an inflammable vapour at a temperature of less than 100° of Fahrenheit's thermometer."

It will thus be seen that the legal definition of petroleum is a wide one, embracing liquid products such as coal-tar and the solid product, paraffin, which are not petroleum in the commercial acceptance of that term; and it will further be observed that for legal purposes in respect to storage an arbitrary limit, based upon the temperature at which inflammable vapour is given off, is fixed.

It may be usefully noted that the terms Rangoon oil and Burmah oil are those referred to in the Act of 1868, at which time petroleum was imported from the Burmah oil-fields, Rangoon being also mentioned as the port of exportation. Petroleum was previously imported only from the United States. Since then, of course, by far the larger quantity comes from Russia, and some also from

Roumania and Borneo, and to be completely up to date these places should also be mentioned.

Petroleum is found in many parts of the world oozing or flowing from outcrops of porous rock, and from this mode of occurrence it derived its name, which means literally rock-oil—Latin, *petra* (rock) *oleum* (oil).

Petroleum was known to the Persians, Greeks, and Romans under the name of Naphtha, a name which is still employed in Russia to designate crude petroleum, though elsewhere it is applied to certain descriptions of distilled petroleum spirit, and should more correctly be confined to the volatile products derived from coal-tar.

In the Old Testament there are numerous references to petroleum, among which may be noticed "The Vale of Siddim was full of slime pits" (Genesis xiv. 10); the word, which is translated *slime* in our version, appearing as "*bitumen*" in the Vulgate. In Genesis ix. 3, in the description of the Tower of Babel, we are told that "slime had they for mortar," whilst we find in Job xxix. 6, "and the rock poured me out rivers of oil." In the Scriptures the word *salt* is used indiscriminately for common salt, nitre, and bitumen, and Lord Playfair suggested that the New Testament reference to salt losing its savour was meant to apply to petroleum, which, on exposure, parts with its volatile constituents and thus yields asphalt, good only to be "trodden under foot of men."

It has been successfully contended in the Courts of Law by local authorities empowered to take action under the Petroleum Acts that mixtures containing petroleum (as defined by law), such as india-rubber solution, paints and *varnishes* come within the legal definition; therefore, if any such mixture gives off inflammable vapour below the legal limit it can only be kept in pursuance of the provisions of the law. This seems a commonsense definition, for experience has shown that the mixtures in question may be as liable to ignition or to create, by volatilisation, an inflammable or explosive atmosphere, as certain descriptions of petroleum unmixed with other substances.

We have a striking illustration of this in the explosion which recently occurred at the works of Messrs. Holcroft at Bilston in the store in which they kept their varnish for japanning purposes.

They had apparently taken all usual precautions, and a strong point was made that no naked light was allowed to be used; b- just to show how liable these regulations are to miscarry, the p

lad who was sent with a vessel to draw off the varnish in the of the afternoon admitted before he died that he struck a ma see if the can were full, and instantly the fire occurred curiously enough, the three men who were killed owed their to an after-explosion of vapour occurring after the fire was th to be extinguished.

In going through bedstead and japanning works you will the tins or cans of varnish bear this notice—

"This varnish contains petroleum·product, which gives inflammable vapour at a temperature of less than 73° Fahr., a therefore, in accordance with the Petroleum Act of 1871, lal highly inflammable."

I have been glad to notice of late that the inspectors unde Act have been very energetic in seeing that at bedstead and works where black varnish or japan is used the stores are pro constructed, with floors sunk at least one foot below the outer level and with a slope towards the tank, and with proper ventil pipes to the outer air. The only suggestion I would make is fine wire gauze be placed in these ventilating pipes in order sparks from outside may be unable to find their way int interior of the store.

Another point I might suggest to fire surveyors in inspe bedstead and other works where japan is used is to ascertain w make is used. There are certain recognised firms of good stan in this country whose varnish can be relied upon as of good qua but there are also American goods on the market, not necess cheaper, but sold specially for quick-drying work, which ca regarded only as very dangerous to use, being liable to c explosion in the drying-stoves.

Spirit varnishes, which are largely used by French polishers for cabinet work, might be regarded from their name as b risky compounds; but, as a matter of fact, they are very safe, b largely, and indeed principally, made from methylated spirits.

At the same time, I think it is an anomaly that methyl spirits and ether have not been brought under the Petroleum In Birmingham I know several places where very large quant are stored, and as they are not in the Act the inspectors have authority for seeing to the safety of their storage.

Lacquer is made to a small extent by varnish manufactu but principally by certain old-established firms who do not m varnish but confine themselves to the manufacture of lacquer,

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from fire that usually it is the case that firms will not pay the rate of 21s. per cent. which we usually charge, and prefer to be their own insurers. Invariably the making-shop is isolated from the rest of the works.

The insurance on a varnish works of any size runs into large figures because of the value of the manufactured product. The great thing is to get the stock of varnish, stored as it is in vertical tanks made of boiler plate, placed in warehouses or storerooms, preferably of one storey in height; the varnish being conveyed by gravitation or by means of force pumps along pipes into the storage tanks; the entrance to the building being protected by an iron door, and the floor sunk below the ground level; the storerooms being in isolated blocks, with a fair amount of space between each; the lighting being by electric incandescent light only; and the heating (for it is necessary to keep the varnish from coagulating) by low-pressure hot-water pipes or by steam heat.

The other point is, that necessarily there must be a considerable amount of raw material stored on the works, such as petroleum (which, as we have seen, is well looked after by Government inspectors), turpentine, methylated spirit, and, to some extent, ether, gums, and resins.

These, taken with the varnish, make up, obviously, a pretty inflammable stock, and if a fire of any magnitude once got a good start on any of these works there is no doubt a considerable conflagration would ensue.

In this district the experience has been remarkably favourable. One firm, whose insurance I arrange as representing the leading Office for something like £160,000, was established in 1803, and has the remarkable record of never having made a claim upon the Insurance Companies in respect to their varnish works. I only charge them what I consider a moderate rate for their insurance; but they, on the other hand, point to their remarkable record, and claim that they ought to be charged very much less. I always say to them—"I am quite sure you do not want a fire, and if one should unfortunately occur, neither you nor I can say what dimensions it might assume"; and this, I think, is what we, as Insurance men, need to keep in mind as regards this class of risk, viz., that a fire *might* assume very serious dimensions, and we ought to bear this in mind in fixing our rates.

I fear there is an inclination on the part of some who look at the immunity from fire, at all events in this district, of this particular

class of risk to accept low rates ; but, personally, I consider that 10s. 6d. per cent. should be considerod the minimum rate for a varnish store, and anything below this is placing the insured at much too low a figure.

In conclusion, I would say I have endeavoured to place before you a few thoughts which occur to me from my knowledge of this particular industry. It may be that in these remarks, to the young surveyor and the rising generation of Insurance officials there may be some grains of useful information, and if I have in any way added to their stock of useful Insurance knowledge I shall feel that my labour has not been altogether in vain.

OIL MILLS.

By F. E. COLCHESTER,
Assistant District Manager, Commercial Union Assurance Company Limited, Leeds.

A Paper read before the Insurance Institute of Yorkshire, 2nd February, 1903.

THE term "Oil" is a name given to certain substances in connection with which it is found that, in spite of many differences of chemical composition and action, they have these points in common, viz. :—

(1) They are composed of compounds consisting principally—sometimes exclusively—of carbon and hydrogen.

(2) They are mostly insoluble in water.

(3) They are readily inflammable.

Oils may be divided into two separate classes: under the first class come those which are of mineral origin, and under the second class those which are extracted direct from animal or vegetable organisms. The latter class is subdivided into two sections: (*a*) the fixed oils, and (*b*) the essential or volatile oils. It is with certain vegetable oils included in the former of these two sections that we have to concern ourselves.

Oils that are known as "fixed" are those which, when heated to a temperature of from 500° F. to 600° F., rapidly decompose, so that they will not admit of distillation in their compound condition; essential or volatile oils, on the other hand, are those which at a certain temperature resolve themselves into vapour without decomposition, and leave little or no residue. A list of all the vegetable oils would be very lengthy, for oil may be extracted from practically all varieties of vegetable growth—from the giant eucalyptus to the blade of grass, from the cocoanut to the mustard seed. The number of fixed vegetable oils

which come within the range of ordinary commerce is, however, fairly limited, those which are most common being colza or rape, castor, olive, cotton, linseed, palm and cocoanut. The seed and fruit of a plant are the sources from which the oil is chiefly obtained, and it is the process by which this oil is extracted to which we have to turn our attention.

Of the numerous oil mills scattered over this country, by far the majority are devoted to the production of two of the above-mentioned oils, namely, cotton-seed oil and linseed oil; although, as a matter of fact, absolutely pure linseed oil is practically unknown, owing to the presence, in the cargoes of seed imported, of other seeds, such as rape and mustard seed, in larger or smaller quantities, which it would be extremely difficult to separate from the linseed, even if it were essential to do so. The production of the other oils above mentioned is confined to certain individual mills which make a speciality of them. There are several reasons for linseed and cotton-seed being the chief materials from which oil is extracted in this country, the principal being, firstly, the great demand for the oils produced, and secondly, the value of the residue left for cattle-feeding purposes. Linseed oil is used in the manufacture of paint, varnish, linoleum, etc., and cotton-seed oil in the manufacture of soap and for lubricating purposes. These two seeds, therefore, are those which are most minutely dealt with in this paper. So far as the principle of extraction is concerned, the method would be practically the same for all seeds, and there is little doubt that if a cargo of some hitherto unknown seed arrived in this country, the average English oil mill could extract the oil effectively without any material alteration in the machinery or usual mode of procedure.

Linseed, of course, is the seed of the flax plant, and is contained in the fruit or capsule which, in shape, is round, and contains five different cells, each cell containing two seeds. The seed, when examined with a microscope, is seen to comprise four outer coatings within which are enclosed two masses of cells (known in botanical language as cotyledons) containing the germ. In the coatings or shell there is a certain quantity of mucilaginous matter, and between the shell and the two cotyledons is a thin layer of albumen. It is in these cotyledons, which, by the way, with the albumen above mentioned form a storehouse for feeding the growing germ, that the oil is found.

The average composition of linseed according to one estimate is as follows:—

Albuminous substance ...	24·44	per cent.
Oil	34·000	„
Germ, sugar, and cellulose ...	30·73	„
Ash	3·33	„
Water	7·50	„

About 26 per cent. of the oil is said to be extractable by pressure. The chief countries from which the seed is imported are Russia, South America, the East Indies, and smaller quantities from Germany, Canada, etc. The Board of Trade returns for the quantities imported are as follows:—

1896.	1897.	1898.	1899.	1900.
Qrs.	Qrs.	Qrs.	Qrs.	Qrs.
2,578,864.	1,908,618.	1,688,515.	1,798,857.	1,666,031.

Until about the middle of the last century the seeds of the cotton plant were thrown away as useless after the valuable fibre which grows upon them had been cut off. Gradually, however, it began to be recognised that the seeds in themselves were far too valuable to be left to rot in great heaps near the buildings into which the cotton was collected, and mills were built for the purpose of extracting the oil and converting the residue into cake. The fibre is stripped from the seed at the place of production by machines known as "Gins," of which a description will be found in Mr. T. A. Bentley's article on Cotton Spinning in Volume II. of the "Federation Journal." The seed, as it is imported into this country, varies greatly in appearance according to the amount of fibre—or lint as it is called—which still adheres to it. When all the lint has been removed, the seed is found to be of a dark brown colour; it comprises an outer shell of stout, rather brittle substance, which under the microscope resolves itself into five layers of tissue, the inside layer being almost colourless, and two cotyledons within which is the germ.

As in the case of linseed, it is in the cells of the cotyledons, which are of a greenish colour dotted with numerous brown specks, visble to the naked eye and containing colouring matter, that the oil lies. The yield of oil per cent. varies considerably according to the country in which it is grown; American seed generally contains less than Egyptian—but we

can take it that the percentage of all seeds is from 24-36 per cent. The Board of Trade returns show that the imports of cotton seed into this country are as follows :—

1896.	1897.	1898.	1899.	1900.
Tons.	Tons.	Tons.	Tons.	Tons.
736,569.	825,560.	860,660.	715,409.	812,608.

The chief countries from which it comes are Egypt, South America, United States, and the East Indies. One notable feature in the oil mill trade of last year has been the enormous increase in the importation of seed from Bombay. It had always been held that if an excessive quantity of fibre was worked into the cake it was injurious to cattle, and plenty of farmers will tell one now that a particular animal, on its death, has been cut open and found to contain a ball of undigested cotton as big as a cannon ball. The imported seed varies very much as to the quantity of fibre which is attached to it. The Sea Island seed, which is mentioned in the Oil Mills Tariff, was obtained from the low-lying islands on the coast of Georgia, U.S.A., and had little or no lint attached to it—under two per cent., as the Tariff expresses it; it has, however, now practically become extinct in the English market. Egyptian seed, too, has very little lint attached, but Bombay seed has a great deal. Thousands of tons of Bombay seed have been crushed during the last year into cake in Hull alone, and you will gather to what extent the fire hazard has been increased in mills using this seed, from the fact that metal particles are often found among the seed, as it is imported, and might pass into the crushing machines. Sometimes the seed introduced into a mill has had all the fibre removed by mechanical means, and it is then known as "Delinted Seed." Sometimes, again, the outer shell is removed from the seed, before the oil is extracted, by means of a machine called a Decorticator. Decorticated cotton cake is not manufactured to a large extent in this country; I know of no Decorticator in use in Hull, but I believe there is one in Liverpool. One more point may be interesting before we pass on to the milling process, and that is the difference in the use of linseed and cotton cakes for feeding purposes. The former acts as an aperient, whilst the latter acts as an astringent. The farmer, therefore, regulates the cake according to his cattle's requirements.

We now turn to the process by which oil is extracted from the seed or kernel and the residue is converted into cake. There are two distinct methods for the extraction of oil, viz.:—

(*a*) Extraction by pressure.

(*b*) Extraction by chemical action.

Of these two, the former is by far the more important, as extraction by chemical means on a large scale is now very little carried on in this country, and, I believe, is not extensively employed elsewhere. There are one or two objections to extraction by chemicals which appear to be fatal to its being carried on generally as a commercial success. Oil cake, as a matter of fact, is, of course, only a bye-product of oil milling, but it has now become a factor in the trade quite as important as the production of oil; as regards its commercial value, it depends, among other things, upon the proportion of oil left in the material, and, also, upon the taste. The process of extraction by chemicals removes the oil too completely, with the result that the residue is practically deprived of its marketable value, from the point of view of the oil it contains. And then, too, it is extremely difficult to remove an unpleasant taste left in the cake, which would be fatal to its value for feeding cattle. Cake for feeding cattle has to be palatable, and this is the reason why you will generally see the intending purchaser of cake taste the sample given him.

We will first, then, turn our attention to the process of extraction by pressure. In 1873 certain material modifications in the methods of milling were introduced into this country, resulting in the more perfect extraction of the oil and the production of better cakes at less cost. The system is known as "The Anglo-American," a name given to it by Messrs. Rose, Downs, & Thompson, of Hull, who introduced it into this country. All new mills are now fitted with this system, and many old mills have had their method of working altered in accordance with it. We proceed then to the description of a typical mill under the Anglo-American system, and, as linseed and cotton-seed are by far the most universally worked materials, we shall assume for the present that these two seeds only are being dealt with.

The seed is stored either in silos or in open floors, and in modern mills a system of elevators and travelling bands is introduced for keeping it in motion mechanically, in order to

prevent the possibility of deterioration by the growth of fungi, by sprouting, or fermentation; a certain amount of moisture is always present in the seed, which would tend to have this effect. In old mills this movement has to be effected by manual labour, which, of course, involves considerable loss of time and expense. Before passing to the mill proper the seed is subjected to a preliminary cleansing operation, in order to remove all foreign matter, such as lumps of dirt, straw, etc., which are always present in the seed as imported. Several machines are used for this purpose, the most common being the ordinary Corn Mill Separator and Grader, the meshes of the sieves being regulated according to the size and shape of the foreign matter to be removed. If the foreign matter is lighter than the seed, a fan can be used for the purpose of its removal. The seed should also pass across the field of a set of magnets in order to draw off metal particles, which are by no means uncommonly found, and which do considerable damage to the mill machinery, not to mention the danger of sparking.

From the warehouse the material is conveyed to the mill into bins, which generally are of a capacity sufficient to contain seed for about eleven hours' working, and are situated immediately above the first process machines.

The preliminary processes are those which just crush the seed sufficiently to break the cells in the interior of the seed, in which the oil is contained, without pressing out any of the oil; the weight, therefore, which is applied must be just sufficient and no more to effect this purpose. Before the introduction of the Anglo-American system, the preliminary crushing was effected by means of stones, and a certain amount of oil was wasted when linseed was being dealt with. Nowadays, however, both cotton-seed and linseed are passed first through a set of rolls, generally five in number, and set one above the other horizontally, the two top rolls being slightly fluted in order to make the seed bite. When the seed has passed between the top pair it is guided by a metal plate between the second and third rolls and so on to the bottom, it having thus been crushed four times in all, and the pressure increasing with every contact undergone. An illustration of this machine is shown in Figure 1.

A German make differs from the machine described in the

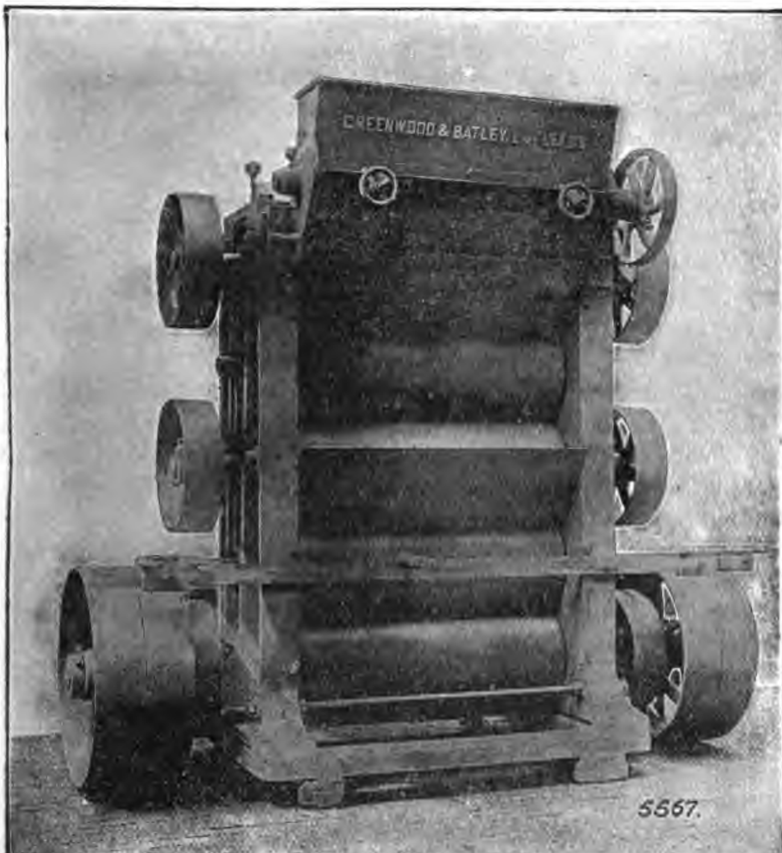


Fig. 1.—OIL MILL ROLLERS.

Fig. 2.—Edge Runners.

fact that the rolls are not set one above the other but are grouped side by side. In dealing with linseed, it is found that this crushing is sufficient to just effect the necessary breakage of the oil cells, but cotton-seed, owing to the greater difficulty in properly breaking the cells, has to undergo a further crushing process. By means of a worm conveyer, therefore, cotton-seed from the rolls is fed on to a pair of vertical stones known as Edge Runners, revolving on their circumferences round a central driving shaft on a stone and metal bed. Figure 2 will illustrate more clearly the way in which the runners work—they are about eight feet in diameter, and weigh about twenty tons altogether. There are two automatic scoopers attached to the driving shaft which keep the meal constantly in the path of the stones. The horizontal stones mentioned and charged for in the Tariff are rarely if ever used now, because the crushing is not done so evenly or well by them.

In order to liquefy the oil in the meal the next process is to apply a certain amount of heat to it. This is done by means of a steam-heated pan known as a kettle, and it is necessary to carefully regulate the temperature, as a disagreeable odour and taste would be developed by partial decomposition if this point were neglected. The application of heat, in any case, gives to the oil a certain bitter taste, and oils which are to be used for alimental purposes, such as salad oil, etc., have to be cold-drawn—in other words, the meal passes direct from the crushing machines to the presses. The colour of cold-drawn oil is always much lighter than that which has been heated. The kettle is from two to three feet deep and about five feet in diameter; it is steam-jacketed, and from the jacket a steam pipe is introduced into the seed chest with perforations at intervals, in order that a small amount of moisture may be caused to percolate thoroughly through the seed, as this is found to facilitate the extraction of the oil and to make the cake adhere together better. In old mills this moisture was sprinkled by hand over the seed whilst under the edge runners. A stirrer, to keep the meal constantly in action, is worked by gearing from above; the temperature to which the kettles are heated for linseed and cotton seed is about 165° F. The material remains in the kettle about ten minutes before being withdrawn through a trap-door underneath. Upon this trap being opened the meal falls into a bottomless metal

box standing on a metal table, of a capacity exactly sufficient to contain meal for one cake When the box is full the trap is closed and the box is slid on to the moulding machine, which stands in close proximity; it consists of a metal table containing a recessed space which exactly contains the contents of the box, and the shape of which corresponds roughly to that of a finished oil cake. The workman swiftly slides the box on to the table over this recess into which the meal falls, and the box is again

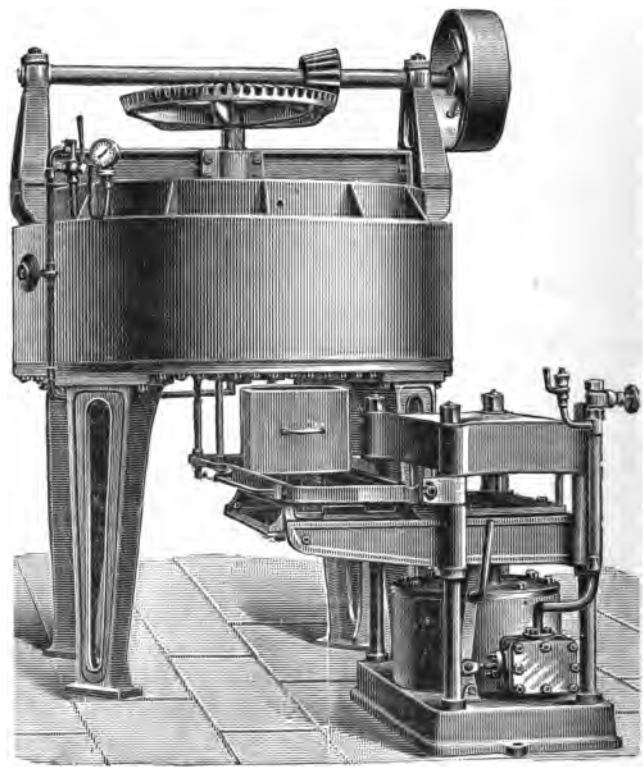


Fig. 3.—Steam Kettle and Moulding Machine.

replaced beneath the kettle ready for another charge. The recessed space containing the charge of meal is then pushed beneath a light hydraulic press, the ram of which rises from below and applies just sufficient pressure to make the meal adhere together without expressing any oil. The moulding machine is one of the innovations introduced under the Anglo-

American system, and the great advantage gained by it is that the bags or "envelopes" into which the meal was formerly filled before being placed in the presses, and which were constantly wearing out, are no longer necessary. The Kettle and Moulding Machine are shown in Figure 3. Upon being withdrawn from this press, the cake is ready for the final extracting process by means of the hydraulic presses.

Fig. 4.—Oil Presses.

In order to make it possible to deal with the constant supply of cakes from the moulding machine, the hydraulic presses are worked in tiers of four, each tier being capable of holding from 12 to 18 cakes. The pressure is obtained from pumps and accumulators in connection therewith, the latter being employed in order to obtain a constant uniform pressure. Although the presses are called hydraulic, the description is not

strictly accurate, as the medium of pressure is not water but linseed oil, which is utilised in order to avoid the possibility of water escaping through the joints and damaging the cakes. The presses (Figure 4) stand in metal trays into which the oil flows as the pressure is applied gradually, and from thence is collected into a tank beneath the floor. The pressure exerted is from

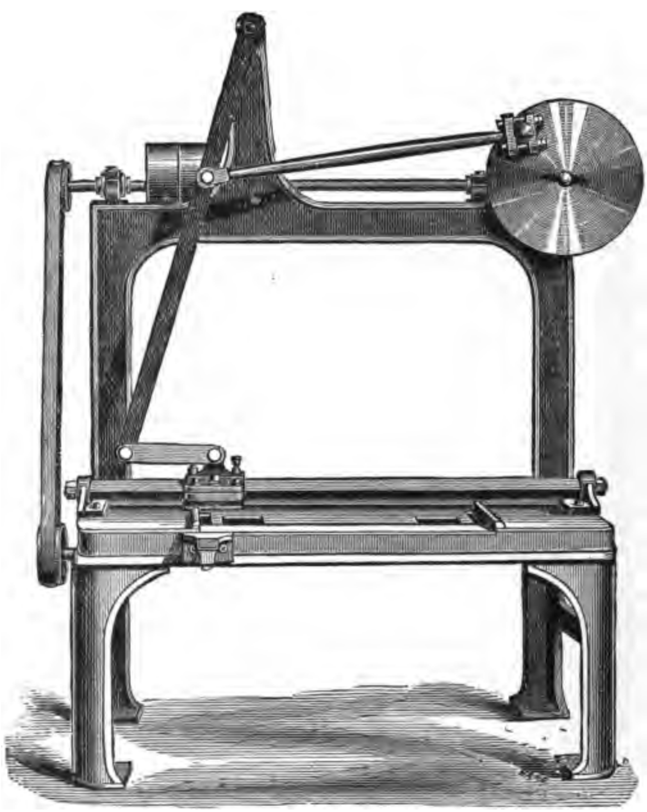


Fig. 5.—Paring Machine.

one to two tons per square inch, controlled by a set of valves in close proximity. When the cake, then, leaves the moulding machine, a wrapper is placed round it lengthways and it is inserted between the plates of the press; when one tier is filled the mechanic applies the pressure and leaves it to take care of itself whilst he deals with another tier. Pressure is applied

for about twenty minutes, and upon being withdrawn the cake is removed, and passed on to the paring machine.

When the cake is under pressure it is of course natural that the oil should emerge through the edges, and the result is that these edges of the cake, when it is taken from the press, contain a considerable percentage of oil which has not been expressed; they are therefore cut off by the paring machine, which consists of a table along the centre of which passes a knife, either worked from above, as shown in Figure 5, or from below. The table is fitted with fences or gauges, so that the cake shall be cut to a uniform size; these are, however, hardly necessary, as constant practice enables the workmen to cut them to a hairsbreadth without any guide. The parings fall into a worm conveyor, which carries them to a pair of vertical stones which differ from the edge runners above described chiefly in their size—they are from four to five feet in diameter. They are also provided with two plates underneath, the higher one being perforated so that the material may drop through it on to the lower plate as soon as it is sufficiently pulverised. From this lower plate the material passes again to the rollers, and so through the same processes as before.

I have endeavoured above to give a description of the usual procedure in modern English oil mills which deal with linseed and cotton seed, and in Figure 6 is given an illustration of the interior of a mill having a single set of machines; additional isolated machines, however, will be found in certain mills for special purposes. For instance, in one mill in Hull there is a machine similar in form to the ordinary hydro extractor with which we are familiar in textile risks; this is used for extracting the oil by centrifugal force from the small quantity of material which is squeezed from the edges of the cake in the presess. In some mills a plant will be found for the manufacture of feeding-cakes; the apparatus does not in itself come within the scope of the Oil Mills Tariff, as no oil is extracted from the materials, but a description of oil mills without some reference to the process would hardly be complete. The materials for feeding-cake vary very much in kind, almost any ingredient which will tend to fatten cattle being worked in; the materials most frequently used, however, are locust beans and grain, such as maize, oats, etc. These are first generally broken up by means of a disintegrator, and

pass from it into a mixer before being finally pressed into cake. The feeding-cake press (see Figure 7) consists of a steam-heated kettle similar to the oil-cake kettle, fixed over a frame within which are two or more upright cylinders, about four feet in length and eighteen inches in diameter. The cylinders are placed beneath traps in the base of the kettle, through which a portion of the heated meal is allowed to fall into the cylinder sufficient for one cake; a metal plate is then inserted by hand and another portion of meal allowed to discharge itself into the cylinder, and so on until the whole cylinder is charged. A hydraulic ram is then brought into action at the lower end of the cylinder, and the meal is pressed into cakes.

The old system of extraction, which was employed prior to the introduction of the 'Anglo-American system, is still to be found in some mills. The chief differences from the modern system consist in the first place in that no rolling process is gone through, the seed being reduced to meal by edge runners only. The kettles vary from the modern ones only in minor details, but the moulding machine as we have seen does not exist; the meal is filled direct from the kettle into woollen bags, each bag holding the material for one cake. The plates of the hydraulic press are shaped to contain these bags, and the oil is squeezed through the material as the pressure is applied. The edge cutting is done by hand by means of a hooked knife. It is further noticeable that in old-fashioned mills the work of conveying the material from one machine to another is done by manual labour instead of by mechanical means.

With regard to the crushing of seeds other than linseed or cotton-seed, the processes are generally similar to those already described, but the crushing of palm nuts, and coprah or cocoanuts, is an exception to this. There are only a few mills in this country which deal with these materials, and I have been unable to gain admission to any of them owing to certain processes being kept secret; the main difference, however, in the system lies, I believe, in the fact that it is necessary to crush the material twice owing to the large quantity of oil contained in it. The presses are considerably larger and heavier than in the ordinary mill, and after being pressed once the material is broken up again by a pair of toothed rolls known as a breaker, and is then pulverised by means of a disintegrator. Finally, it again passes to the kettle for a repetition of the process.

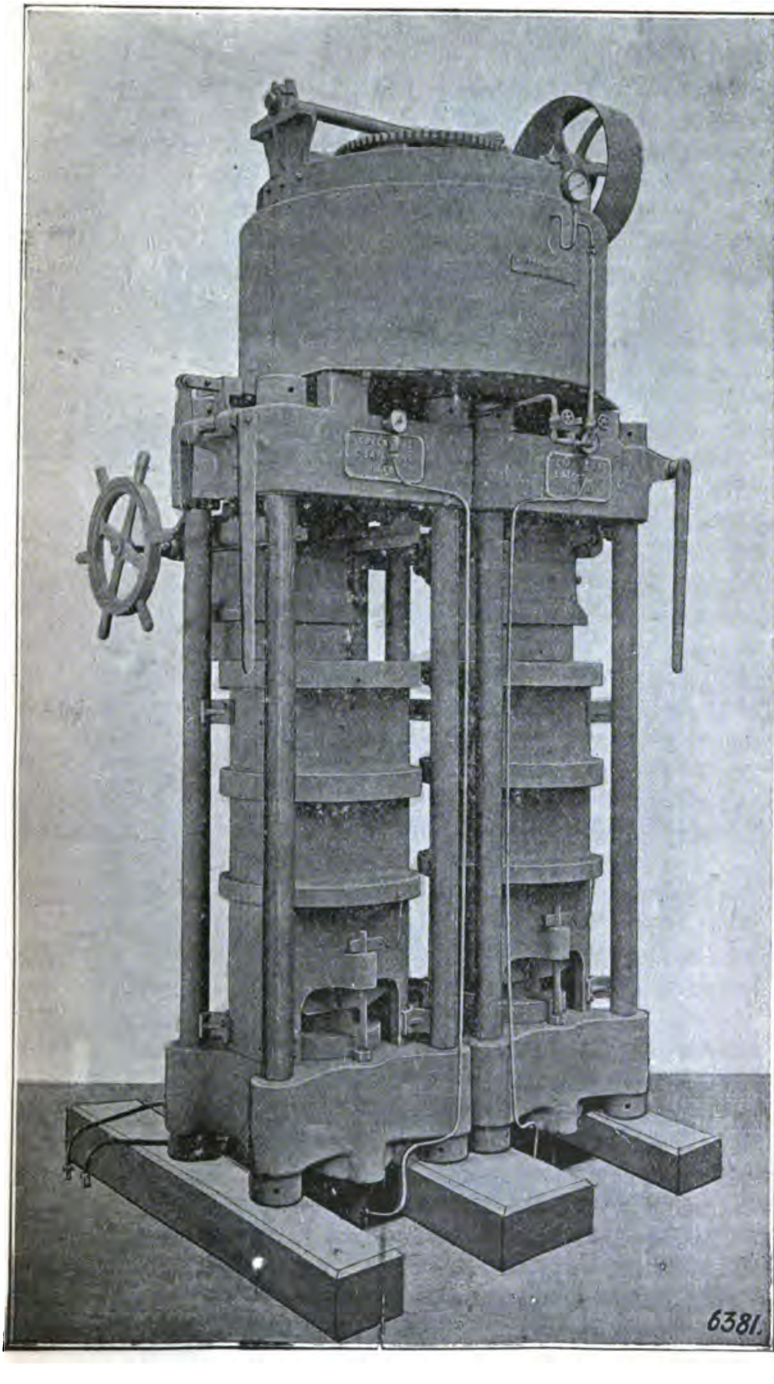


Fig. 7.—Press for Palm Kernels and Coprah.

about 165° F., its liability to spontaneous ignition is greatly increased. There are also possible incidental dangers which are present in many other kinds of factories, which are increased in oil mills by the nature of the material; amongst these we may mention one—the possible presence of small particles of metal, or even matches, in the seed as it passes under the stones or rollers.

To sum up, then, the whole matter, the accessible evidence points to one conclusion, and one conclusion only, and that is that the large majority of the fires in the class are due to spontaneous ignition. It is a fact that out of 20 outbreaks of fire in Hull, between the years 1890 and 1904, 15 have broken out between the hours of 6 p.m. on Saturday and 12 o'clock on Sunday night —that is some hours after the mill was closed. Of the remaining outbreaks, two were absolutely known to have originated in the mill, which was at work at the time; one started in the mill where apparently some fluff and dust on a gas pipe burst into flame; in another case some empty bags on a warehouse floor were observed to catch alight; and in the last case fire was discovered in the warehouse above the mill at 8 p.m. whilst the mill was working, the cause being unknown. Again in 11 cases, out of these 20 fires, inquiry showed that the flames had first been seen in that portion of the premises which were used for storage purposes. Now these facts appear to be very striking and to bear out the conclusion mentioned above. They are drawn from the Hull experience only, and it would have been interesting to have got as full details with regard to the fires in London mills. *One* epidemic of fires there was attributed to the introduction of bisulphide of carbon for experimenting in the extraction of oil. A discrimination between those fires which took place in mills using linseed only at the time and those using cotton seed would be valuable, but reliable statistics are not available. There is a tendency at present to lay all the blame on the latter, but there are several instances of disastrous conflagrations having taken place in mills using linseed only.

What, then, is it possible for the Insurance Companies to do to prevent these conflagrations in future?

In the first place, manufacturers should be advised of the extreme danger of allowing seed to be stored in their warehouses in a damp condition, and it is no exaggeration of the risk if stress were laid upon the importance of precautions being taken at times, when the air is much impregnated with moisture, against the

damp settling into the seed. Furthermore, seed should not be stored in the full glare of the sun, for it has been found that the tendency of oily material to ignite is much increased when the sun is playing upon it.

Then, again, strict instructions should be given that anyone found smoking on the premises will be summarily dismissed, and the hands should be advised as to the danger which would arise from a single match having inadvertently got among the seed. Then, again, steam and water pipes should be carefully looked after to insure that they do not leak. Magnets should be provided to the trunks supplying seed to the stones or rollers. Lastly—and this is perhaps the most important point of all—metal receptacles should be provided, into which all textile material or waste should be placed. Further, a stringent warranty should be inserted in the policy against any such material being allowed to remain exposed to the air after the mill is closed.

In conclusion, I would mention that I have not touched upon the subject of oil refineries, which deal with the oil after it leaves the mill, thinking that the processes do not come strictly within the scope of this paper. The diagrams of the machines were kindly supplied by the manufacturers, Messrs. Rose, Downs, & Thompson, of Hull, and Messrs. Greenwood & Batly, of Leeds.

FIRE EXPOSURE HAZARD.

By ROBERT M'CONNELL.

A Paper read before the Insurance Institute of Manchester, 12th April, 1904.

In commencing a paper on the exposure hazard in connection with fires and its relation to fire underwriting, it is difficult to decide how to introduce and develop the subject so that one's remarks may be comprehensive and free from commonplace and yet may embrace the rudiments as well as the complexities of one of the most difficult problems of the present, and possibly of the future, with which fire underwriters have to deal. That exposure hazard is an important factor does not require to be stated, but to measure and codify and expound its features, is a task which one may be pardoned for undertaking with some diffidence. Of course, for trained Insurance officials much may be taken for granted, but one of the objects of this paper is to provide, in an appropriate form, something which may be educational not only to younger students of insurance practice but also, although perhaps in a lesser degree, to those outside the Insurance field who have to provide by the payment of annual premiums the funds from which losses are made good, and in whom the steadily increasing cost of Insurance tends to raise a spirit of resentment, instead of creating a desire to remedy the evil by attacking, not the effect, but the cause.

As it is desired that this paper should be of general rather than local interest, I will endeavour not to dwell too largely on Manchester conditions; but as my experience is based upon closer acquaintance with Manchester than any other centre, I must perforce make use of local information more freely than would otherwise be necessary. I think, however, it will be agreed that the greatest conflagration risks are associated with dry goods warehouses, and it is possible, therefore, that conditions which prevail in Manchester may very fairly be

typical of those which exist in the congested districts wherever exposure hazard occurs to any serious extent.

The features of exposure hazard are many and varied, but may be conveniently divided into two broad sections—(1) the inherent exposure hazard, *i.e.*, that which arises from conditions existing within a specific building or place; (2) the extraneous hazard, *i.e.*, that which is created by the existence of adjacent or contiguous buildings.

With regard to the inherent hazard, there is undoubtedly a much greater exposure hazard in many places of business than is really necessary. This occurs from a variety of causes, but principally from two—first, convenience or economy in carrying on relative processes and in securing adequate supervision; second, the ignorance or indifference of the individual proprietor. Respecting the first of these there are very few trades where some one of the processes is not of greater hazard than the others, and in some instances it is impossible to detach such a process without creating dislocation or adding to the expenses of management, but in many others it is not only possible, but the sequence of process may actually facilitate such isolation. In this connection it is interesting to observe the difference between risks which are subject to Fire Office legislation and those which are not, and herein lies one of the strongest vindications of the Fire Offices Tariff system. The most notable examples of the influence of Tariffs in minimising the inherent exposure hazard, to the advantage of the insured no less than that of the insurers, may be found in the case of Textile Mills, and, perhaps, especially Cotton Mills. The processes in a Cotton Mill lend themselves readily to this; but the effect of Insurance practice has been to entirely influence the arrangement of mills, so that the isolation of the hazardous preparatory processes is now always provided for in the design of a mill, although the fact that the practice originated from Insurance requirements has probably been quite lost sight of. Another more recent example of the ultimate advantage arising from what were at first regarded as onerous and irritating Insurance conditions, is found in the case of Tanneries. The fire waste in these risks has been enormous in past years owing to the aggregate value exposed to an outbreak of fire and the non-isolation of objectionable processes; but after the situation had become intolerable the combined experience of the Fire Offices

enabled conditions of insurance to be framed which have had the effect of greatly reducing, if not eliminating, this exposure risk.

The process of dealing with inherent exposure in the case of risks subject to Tariff provisions is comparatively simple, as the imposition of a penal rate is generally sufficient to induce the insured to adapt his works in order to save the extra cost of insurance; but, unfortunately, it is very difficult at times to convince him that he is otherwise a gainer, as it seems impossible to bring home to the ordinary policy-holder that Insurance requirements are the outcome of long experience and seriously applied technical knowledge, and that whatever conduces to the reduction of fire risk is a direct gain to him, not only by reason of his greater immunity from the direct consequences of a fire, but also because of the lesser amount of premium which must be collected from the community generally to cover the cost of reinstating something which has passed entirely out of existence. In the case, however, of risks which are not governed by Tariffs, the difficulties of applying the principles of underwriting in connection with exposure hazard are very great, and firms of even the highest standing will sacrifice everything to expediency. What Insurance official has not observed the fatal regularity with which hazardous features are located at the precise point where they create the greatest possible menace to the surrounding premises? For instance, in an engineering works, why is the hazardous woodworking department so often found in the loftiest building and openly communicating with and exposing to all its risks other buildings which in themselves are comparatively non-hazardous, and why is the storey over the woodworking shop so frequently used for the storage of the valuable and highly destructible stock of patterns? Perhaps nothing could so effectually dislocate the business of an engineering firm as the sudden loss of its patterns, and yet nothing will stop its responsible officials from so placing them as to expose them to the greatest danger of which the works will admit. Take, again, the case of a Calico Print Works. Here, in a well-arranged works, it should be a simple matter to subdivide the premises so that the parts containing the greatest value are free from exposure to a fire in the more hazardous portions, and yet how rarely does this occur? The white stock could be warehoused suitably for ready transmission to the processes, and the finished printed stock equally isolated, and the

hazards arising from singeing, printing, hanging, ageing, drying, &c., be confined within their own section, but in practice the stock-rooms are generally involved with the rest of the works, and serious losses sustained which might be avoided without the slightest prejudice to the efficiency of the works. The storage of hazardous goods indiscriminately with others of less hazard is also much more unnecessary than will be readily admitted, and in the absence of Tarriff conditions it is sometimes difficult to secure isolation even where the proportion of such goods to the total is so small that special accommodation could be provided without much inconvenience or expense. For instance, I have a case in mind of a warehouse used for the storage of iron and steel in the form of bars, rods, and blocks, which ordinarily might be regarded as an ideal subject of insurance. It, however, became necessary to keep some of the stock painted to prevent rust, and the whole stock was consequently likely to be exposed to serious fire and water damage by the introduction of a paint mill and a large stock of oils and colours to the main building. It may be that the risk would not have been very much increased thereby, but it was a totally unnecessary exposure, and at very little cost a fireproof room was provided so that the valuable stock might continue to be subject only to its natural minimum risk. It is impossible to estimate the extent to which the community has benefited or is likely to benefit by discrimination of this kind, but whenever miscellaneous stocks accumulate it is certain that the fire risk can be reduced if regard be paid to this question of exposure. In the case of dock warehouses the saving in the fire waste must be enormous from the systematic elimination from non-hazardous stocks of such goods as nitrates, oils, vegetable fibres, &c., and a double advantage arises, because not only are general stocks free from the exposure arising from those which are more hazardous, but the fire risk in the latter is probably also reduced because of the more suitable storage conditions resulting.

Another important phase of inherent exposure hazard is that arising from plurality of tenure, more particularly in the cases we frequently see of a building where all the tenancies are non-hazardous save, perhaps, one which, by reason of the class of stock or processes, jeopardises unnecessarily a large aggregate of stock. This point is of much importance in any large city where a considerable amount of warehousing occurs. Plurality of tenure must exist, as there will always be a great number of people

whose business is not sufficiently large to occupy a whole building. But why should not greater attention be devoted to having only tenants of a similar degree of hazard in each building? This is one respect in which Glasgow, and perhaps also London, incurs a heavier loss record than might otherwise be the case. In Glasgow the tenement warehouses are, as the rule rather than the exception, jointly occupied by warehouse and manufacturing tenants, and sometimes a considerable accumulated hazard exists in a building where at least some of the tenants would be less subject to this exposure if some method of selection and classification of tenancies existed. It may be much easier and more profitable to let the top storey of a building to, say, a printer than to a warehouseman, but, taken as a whole, the community is worse off because of the increased exposure hazard to which the other tenants are subjected. It may also be contended by Insurance experts that the accumulation of risk is already so great by reason of the number of tenants that the fact of one or two out of the number being somewhat more hazardous does not make any serious difference. I am, however, in favour of entirely eliminating, if possible, every extraneous feature from a warehouse building, and although the factory building may become correspondingly a greater hazard, it is, after all, in the warehouses that heavy values accumulate, and for the sake of general public economy these should be protected as much as possible from exposure hazard.

We now come to the second section of our subject, *i.e.*, the extraneous hazard, and this is of much greater importance than that which we have been discussing, inasmuch as up to this point we have been dealing with a phase of the question where the hazard is readily apparent and can be estimated with a reasonable degree of accuracy by any Insurance official. The extraneous hazard is, however, something which, while obvious, is so uncertain and varying in degree that I do not think the cleverest underwriter of the day would, even after a lifelong experience, pretend that the subject had no difficulties for him. The question is not a new one, but it is of greater importance to-day than at any previous time in the history of Fire Insurance, and present indications all point to its growing seriousness. Apart from the technical difficulties of the subject, underwriters cannot get away from the discontent of the public. This discontent, unfortunately, does not arise from any public recognition of the seriousness of

the situation, but, in accordance with the remarkable aptitude which people have for confounding cause and effect, from the growing cost of Insurance. The point the public do not understand is why in these days of good water supplies, elaborate Fire Brigades, costly extinguishing appliances, fire alarms, and telephones, Insurance should not be cheaper than it was in days gone by, when aids to fire extinction did not exist or were exceedingly primitive both in establishment and administration. Insurance is cheaper in a large number of classes of risk, but it is not cheaper, so far as I am aware, in any instance where the factor of exposure hazard enters. It is, on the contrary, in all such cases dearer, and sometimes very considerably dearer, and, I fear, destined to become dearer still wherever the prevailing conditions are year by year adding to the accumulated value of the property in congested districts.

It is frequently the subject of comment that great fires are of such frequent occurrence in the United States and relatively of rare occurrence in the United Kingdom. Many theories are put forward to explain this, such as the atmospheric conditions, the prevalence of electricity, &c., &c., but while these are no doubt important, they are not altogether convincing. The difference cannot be because of any difference in Fire Brigade service, as fire extinction and the study of appliances have almost been reduced to a science in the United States; nor can it be due to promptitude in giving the alarm, as automatic fire alarms, thermostats, &c., are in free and general use, and in all such respects our cousins are the best-equipped and the most up-to-date in the world. I am inclined to attribute the difference as due, in part at least, to the modernness of things across the water. In our great cities—London, Manchester, Glasgow, &c.—the development of city conditions from stage to stage is slow, and whereas 40 or 50 years ago warehouses were small and self-contained, and owing to their limited size, fairly well lighted, the new warehouses are of a wholly different character. No one thinks nowadays of building a small warehouse; no one could afford to limit the height to, say, four storeys; no one could build a well-lighted warehouse without internal structural defect; and it is very difficult to lay out a new central city situation in small blocks well subdivided from one another. Instead, we find the tendency is to erect very large rectangular blocks intersected through the centre by narrow streets, and having on the side facing those

narrow streets a maximum amount of glass with a minimum of substantial construction. These modern descriptions of warehouses exist at present in company with a large proportion of the older types which, while in themselves individually inferior fire risks, are collectively much less liable to extensive destruction. In the United States this is different. The growth has been rapid, and the conditions, which are slowly but surely growing up in our large centres, exist in the States to a much more general extent.

The chief features of exposure hazard proper may be summarised as follows :—

1. Excessive size of individual buildings.
2. The existence of internal areas and well-holes for lighting, which in a large proportion of cases are common to two or more warehouses and are frequently quite inaccessible from the street.
3. The close proximity of warehouses across narrow streets, courts, yards, &c.
4. The laxity of building bye-laws with regard to the use of timber in walls facing areas and narrow streets.
5. Excessive window openings in opposing or adjacent buildings.
6. Wood and glass construction in roofs in the form of skylights, mansard roofs, louvred lanterns, projecting dormer windows, &c.
7. Imperfect or inadequate party walls.

In degree of importance these may almost be taken in the order given, and we may regard the first three as almost inseparable from modern conditions and, consequently, likely to be found as permanent features. Of the remainder, 4, 5, and 6 exist freely, but are capable of considerable amelioration, while the seventh is negligable in the case of new buildings, but in most districts the older buildings will be found defective in this respect. Any one of these features is naturally of importance according to the extent or nature of the particular defect, and when they occur in combination the degree of hazard may be extended to a point which cannot be estimated, as all our views being of necessity relative and comparative, we are apt, when we get beyond an accustomed limit, to reach the stage of guesswork.

The question of size is really of the first importance, especiallv

if two or more very large warehouses are in juxtaposition. If we assume that a 60-feet cube, *i.e.*, a building containing from 200,000 to 250,000 cubic feet, is as much as an ordinary efficient city brigade can be expected to control, if well on fire, the probabilities are that streets of, say, 30 feet in width between it and the surrounding property will be sufficient cut-off in the event of a serious fire. The same would hold good if adjoined on one or two sides by similar warehouses with complete party walls between. If, however, we double the size of the warehouse and take it at, say, 400,000 feet, it is obvious that the value of the 30-feet street is very greatly reduced, and if we double it again to, say, 800,000 feet, it would be very difficult for the Fire Brigade to work at all in a street of that width; and if the fire crosses the street to a warehouse of similar size you have two uncontrollable fires in progress, with, probably, other warehouses in much closer proximity behind or at the side of each which may readily be embraced by the fire. When that point is reached there is practically nothing which is not possible in the way of a large conflagration, and as the fire gains in magnitude so do possible cuts-off lose their value. This illustration is based on a supposed serious fire originating in a warehouse of 800,000 cubic feet. Such a warehouse could not be built in London nowadays, as the London County Council building laws prohibit warehouses of more than 250,000 cubic feet; but in Manchester the most recently erected modern warehouse contains a cubical capacity of no less than 1,300,000 feet, without any internal division walls, while there are a considerable number containing upwards of 800,000 feet. Warehouses having a capacity of 500,000 cubic feet and upwards are likely to greatly increase in number, and, with the exception of London, I know of no district where any limit is in vogue. Towns such as Manchester, Glasgow, Nottingham, Bradford, and Belfast seem to find large warehouses a commercial necessity, and in the absence of restrictions will go on building them, and in the case of dry goods warehouses every one of such buildings will probably have an internal area or well-hole likely to cause the total destruction of the warehouse by any fire not extinguished in its very early stages. The value of the building and contents may be roughly taken at something over £1 per 10 cubic feet, so that a warehouse of 500,000 capacity represents a value of £50,000 to £70,000, increasing proportionately in the case of larger build-

ings. It follows that, as these warehouses increase in number, the losses of £50,000 and upwards will occur with increasing regularity, and the cost of insurance must consequently develop on the same basis. This development in the size of buildings is not confined to warehouses, but seems inclined to extend all round. In the case of cotton mills the disastrous collapsing of fireproof mills is an experience of only the last 12 or 14 years, the reason being that the mills erected during the last 20 or 25 years have grown steadily larger in type. The old fireproof mills being of long and narrow design are unlikely to collapse, and the whole value is not therefore exposed to a single fire, but the newer mills are not only quite as long but are practically double the breadth, with the inevitable effect that not only is the structural value of the fireproofing rendered unreliable, but the exposure of value is enormously increased. Many other examples might be given, but they will suggest themselves. This tendency, however, may, I think, be taken as accounting, at all events to some extent, for the growing unprofitableness of farming insurances. In many districts it is now the practice to accumulate all the season's produce in a barn of very large capacity instead of distributing it in smaller buildings and stacks, and whether the actual number of fires has increased or not there can be no doubt as to the increase in the number of losses of serious amount entirely on account of the increased exposure of property to each outbreak of fire.

It is interesting to review the various means which the Fire Offices have adopted to collect the appropriate premium in risks where this form of exposure hazard occurs. In the case of shops and a few other classes the number of assistants is taken. In corn mills the rate is affected according to the output based on the extent of roller contact, and in cotton mills by the number of spindles. In the northern districts, in the engineering trade an attempt has been made to grade by the number of machines in use, but with problematical success. In warehouse risks the system which undoubtedly works with the least friction and the most logical fairness is that which has been adopted for some time past in London, Glasgow, and Bradford, and more recently in Manchester, of applying a cubical capacity charge, which is not only appropriate to present conditions, but will, to a large extent, automatically keep our rating apace with any further development which may take place in the exposure

hazard arising from excessive size. Indeed, the application of an extra rate, graded according to the cubical capacity, to every class of risk would be an equitable and logical proceeding.

With regard to the other exposure features to which I have referred, those arising from structural defects are usually provided for in a more or less adequate form in the various Tariffs, but, as a rule, the extra charges therefor are applicable only to the particular building affected, and the system of rating will always be imperfect so long as these objectional features do not also influence the rate for any buildings which are menaced thereby. The practice of the Fire Offices is not yet properly standardised, and it seems curious that, although the conditions in most important warehouse districts are analogous, there is no general method of rating for exposure hazard. Many of the present Tariffs do not provide any extra charge, but even in those which do the charge is sometimes only applicable if the exposure is to risks of a similar character. The tendency, however, appears to be towards more comprehensive treatment, and undoubtedly there is scope for this. It is very remarkable that in Manchester the charge is inapplicable except in the case of area exposures, while there is no provision for exposure risks in the case of the Leeds and Bradford woollen warehouses or the Nottingham lace warehouses. The Glasgow conditions are, perhaps, the most complete and modern, as, in addition to the usual extras for construction, height, cubical contents, and tenancies, all of which are in their way exposure charges, we find extra charges (1) for each building with which there is any communication not across a fireproof compartment properly cut off; (2) for openings into any enclosed area; (3) for any timber, or timber and glass, erection on the roof; (4) for any unprotected opening above the ground floor within 20 feet of any opening (protected or unprotected) in any other building of a specified degree of hazard, or within 20 feet of the non-fireproof roof of any such building; (5) an increased extra for the same feature of hazard within 10 feet instead of 20 feet. The London dry goods warehouse provisions are slightly different, but in general idea similar. The items consist of charges (1) for imperfect walls, (2) for skylights or glass construction in the roof, (3) for any unprotected opening into an area, court, or passage between and common to the warehouse and any other building, (4) for any unprotected opening (in the roof or any other part of the building) opposing and within 20 feet of any opening (pro-

tected or unprotected) in any other building, or overlooking and within 10 feet of the roof of any other building. In the case of Belfast warehouses the conditions are very nearly identical with those for London, the chief variation being that the charge for defective roof construction is very much higher, no doubt the result of local experience. It will be observed, however, that in principle the three centres dealt with are on the same footing, and there appears to be no reason why a general assimilation of the features to be penalised should not be made and adopted for all dry goods districts, the actual charges for each to be variable as far as may be necessary to meet local conditions and experience. For example, I can see no reason why Manchester and Nottingham should be treated differently from Glasgow and Belfast in this respect, and yet there is no exposure charge proper in either of these towns, although in Manchester the "area" charges to some extent meet the necessity, viz.:—For any opening into an area into which any other warehouse has an opening, the walls of such area being (*a*) of brick or stone, (*b*) of any other construction. This is, however, an unsatisfactory and inadequate provision, as in the interpretation of the term area it is the practice to treat every *cul de sac*, no matter how wide, as an area; but a court, laneway, or other narrow street having an open thoroughfare, even for foot traffic, is not so regarded, however imminent the opposing windows may be or however inferior the construction of the opposing walls. Furthermore, the exposure is not penalised unless it be to another warehouse, whereas in the other cases cited a wider range is embraced. I consider, however, that all the provisions referred to are defective in not making a distinction where the exposure is to or from a building the opposing walls of which are not entirely of brick or stone, as one often sees the side of a warehouse facing a narrow street partly, or, indeed, sometimes wholly of wood and glass construction.

In considering the conditions under which exposure hazard is dealt with we are to some extent dealing with the question in detail, and it is apparently very difficult to devise a scheme which will not only provide for the various features in particular, but which will also, without unequal and unfair application, meet the cases where exposure occurs in a complicated form. In the first Journal of the Federation of Insurance Institutes a paper appears, reprinted several years after its issue, on "The Accumulation of Fire Risk," by the late Mr. Robb. The paper is

brief and simple in its illustrations, but it is, in the principles laid down, one of the most valuable of the contributions to the Journal, and I think we cannot do better than take Mr. Robb's statement of the case and apply the identical principles to the question of exposure. If we do, we find that two risks of the same description and degree of hazard, if exposed to one another, produce an accumulated risk greater than either taken separately. The remainder is simple. What, then, is the proper estimation of hazard in a block of half-a-dozen or more risks of varying type and degree containing internal defects, external timber constru-tion, roof exposure, and all more or less grouped in a common exposure? I have already said that we get to the region of guess-work when we try to determine an adequate rate for such an insurance. No scheme dealing with features in detail will be found suitable for cases of this description where exposure is found in accumulated form. A new departure has consequently been made in this country by the adoption of a system of adding to the ordinary exposure charges a general "block" extra adjusted, so far as underwriting judgment will permit, to the degree of hazard contained in an aggregation of buildings presenting a combination of features conducive to a great conflagration. The scheme originated after the Cripplegate fire about five years ago, and, although not an ideal method, was found a sufficiently satisfactory solution of the difficulty in London to justify its adoption in Glasgow at the present time, and there seems much to be urged in favour of its extension to other dry goods districts where abnormal conditions exist.

It must not, of course, be supposed that the general conditions of all exposure centres are alike, but the common features are sufficient for all to be dealt with under a well-devised scheme combining the existing provisions, so long as questions of size, tenancies, hazardous goods, internal defects, and inferior construction are independently rated. The great difference between the congested district of London and the provincial towns is that there is very little inferior external construction in London. The Building Act is carried out in letter and in spirit, and not only are all external walls of brick or stone, but it is quite exceptional to find windows of abnormal size in the narrow streets. The great element of exposure hazard is proximity, and this cannot be remedied. The streets are all very narrow and the internal areas are almost all inaccessible. The only safeguard

against recurrences of conflagrations on a large scale are the absence of light construction in area and outer walls, the restricted extent of window openings as compared with the total wall face, and the limitation of the size of all the warehouses except those which date prior to the Building Act regulations. There is of necessity much intercommunication, as a large firm must have adequate accommodation notwithstanding official restrictions, but all communications are protected by double fireproof doors or are through protected fireproof compartments. The warehouses are also more fully stocked and generally present a much more crowded internal aspect than we are assustomed to in Manchester, so that the favourable features are quite counterbalanced by other less pleasing but unavoidable conditions. Another point is that the amount of ground space occupied by blocks of warehouses without any intersecting thoroughfares is much greater than anything we have in Manchester, and a fire may occur in the centre of a block three warehouses back from the surrounding streets, and there is not a square inch of open space into which the Fire Brigade can get, the only means of access being by hallways or passages or from the windows of the surrounding buildings. Some of the blocks in Glasgow more nearly approximate to these in extent, with the difference that the boundary streets are much wider, but there is no block in Manchester approaching the same size which has not some ready means of access to the interior. Taken broadly, if the construction of warehouses in Manchester were as good as in London we should have practically no conflagration risk, while if the warehouses in the London dry goods district were constructed similarly to those in Manchester conflagrations such as the Cripplegate fire would probably be of annual occurrence. A comparison between Manchester and Glasgow would probably show more close resemblance in the conditions, as Glasgow also suffers from the danger arising from buildings of exceptional size and considerable area exposure, but I am inclined to think that we have more wood and glass construction in Manchester than anywhere else in the kingdom. I am not sufficiently acquainted with the details of the warehouses in the Yorkshire towns or in Nottingham to suggest any comparison, but I can go so far as to say that, generally speaking, all that applies to Manchester and Glasgow applies in a lesser degree to these towns also. With regard to Belfast, the conditions are outwardly more favourable, but the

experience belies this impression. So far as I have had opportunities of judging, however, I think that, at all events in the past, Belfast has been proved to be more subject to exposure from inadequate or imperfect party walls, with corresponding increase in the roof hazard, than has been the case elsewhere.

Having dealt in general terms with this subject of extraneous hazard as it appears to me, I may perhaps refer to a few recent cases of new buildings in Manchester to show that, so far from conditions tending to improve, there is grave probability that, as I have said, the exposure hazard is an accumulating one and is likely to cause fire underwriters still greater anxiety as time goes on. I have referred to a new warehouse of a cubical capacity of about 1,300,000 feet. This warehouse, apart from its size, is not abnormal. It is entirely detached, the narrowest of the streets surrounding it being thirty feet wide, so that in the ordinary idea there might be assumed to be little or no exposure hazard. The building is nominally of fireproof construction, *i.e.*, the floors are of concrete supported by unprotected steel columns, and have two openings—one a very large well-hole for light, and the other containing an unenclosed pitch pine staircase, both of which extend from the first to the fifth storeys. Assuming such a warehouse to be but moderately well stocked with miscellaneous wholesale drapery goods, we have to consider the possible effect of a fire. If the warehouse were of moderate dimensions even the narrowest of the streets might be regarded as a sufficient safeguard against danger to the adjacent warehouses; but in the case of the narrow street, where the greatest exposure danger would in any case exist, we find that to obtain a maximum amount of light there is a street frontage of 200 feet, in which the windows are 13½ feet in width, with less than four feet of brickwork between each, and these windows extend from basement to attic with no break from storey to storey, except where the concrete floors are brought through, so that we have practically a continuous glass wall to this immense warehouse opposing a block of warehouses with ordinary windows 30 feet away. In the event of a great fire, the only salvation for the adjacent warehouses would be that the fireproofing might collapse at an early stage in the interior of the warehouse, and thus enable the intensity of the fire to spend itself within its own walls. In this case we have no serious defective construction to contend with; but I will mention two where, in addition to excessive

size, very serious exposure hazard occurs. In one, two warehouses were erected, containing in all nearly 800,000 cubic feet. They did not communicate, but enclosed within the two was an inaccessible area with walls entirely of timber and glass, while on the outer side of one of the warehouses the entire wall was of timber and glass, and formed one side of a yard common to another warehouse of about 400,000 cubic feet, having similar construction extending round two sides of the yard. A fire occurred soon after their erection, practically destroying the two new warehouses, and causing appreciable damage to the third, the total loss reaching nearly £100,000. It might be supposed that this would serve as an object lesson, if not to the owners at least to the municipal authorities; but within twelve months the whole block had been reinstated identically as it had been before, and so remains now, and doubtless history will repeat itself on the first occasion when another outbreak of fire occurs.

In the other case a warehouse of about 1,250,000 cubic feet has been erected within the last two years, the portion above the street level being in two sections, separated by a loading yard 20 feet wide and 114 feet long, the basement and sub-basement being common to the whole. The front wall of the warehouse is of handsome and substantial appearance; the back wall is also substantial, but quite inaccessible. The inner walls, however, forming the two sides of the loading yard, which oppose one another at a distance of 20 feet, and are 114 feet long by 60 feet high, are entirely of timber and glass with exposed iron columns 60 feet high supporting the roof. This in itself is not sufficient, but the warehouse is sandwiched between three other warehouses of considerable size, each of which have timber and glass area walls to the ends of the loading yard referred to.

In Manchester the municipal bye-laws require all external walls to be of substantial construction, but there is great need of a definition of what is an external wall. Apparently walls of timber and glass can be erected without restriction if they are not part of one of the main exterior frontages of a building, and a curious state of affairs would arise if some of the buildings were turned round. The fire hazard would probably be greatly reduced, but the construction would be disallowed and Insurance Companies would be slow to undertake any liability, whereas under the more hazardous conditions amounts are freely accepted. There is no limit of size or height, and the bye-laws provide condi-

tions for walls of warehouses up to 100 feet. The conditions in Manchester will probably be favourably affected by the tendency to build fireproof warehouses; but if this is to happen, some more serious effort must be made to bring the fireproofing up to a satisfactory standard. There seems no advantage in fireproof floors if large openings and wooden staircases are carried through them; nor does a building deserve to be considered fireproof if a large expanse of flooring is supported on unprotected metal columns, or if one of its enclosing walls be largely or wholly of flimsy construction. All these points require careful consideration, because until we can prevent fires from occurring we must consider what the result will be when they do occur. Everything that will delay the development of the fire must be advantageous. If a fire develop rapidly and involve the whole building, the possibilities of its extension to other buildings are very great; and if this should occur, what is the prospect of a Fire Brigade coping with it? Much depends on the size and type of the original building, and on the susceptibility of the surroundings to receive the fire. It stands to reason that features which create conflagration and exposure hazard, while rendering a building more readily combustible, would be comparatively negligible if it were possible to confine the fire to the building in which it originated. When, however, fire starts in a building which, either in itself or by reason of defects in the adjacent structures, is a naturally good channel for the conveyance of fire, it may be necessary to forthwith direct all energies towards protecting the surrounding property, in which event the attack at the seat of fire is weakened; or if, as is more probable, the first efforts are applied to a direct attack on the fire, the danger is that should the latter gain headway with any rapidity the fire may assume such dimensions as to render abortive such efforts as can be made to save the surroundings. The history of nearly all conflagrations tends to show that the trouble has resulted not from the fact that one building has got beyond Fire Brigade control, but that owing to the exposure of another building the Fire Brigade work is rendered more difficult; and when two large buildings in such circumstances become involved, control is out of the question and the conflagration results.

The question naturally arises whether it is not possible to do something to bring about a better condition of things in this matter of exposure risk. It does not appear to me that we as

Insurance Companies can do much so long as the public authorities are indifferent. We already apply penalties in the form of extra rates, which to some extent may influence the construction of buildings if this question be kept in view, but what is really necessary is that building bye-laws should very stringently prohibit the use of timber in the exposed portions of city buildings, that definite conditions should be laid down regulating the size of warehouses, the nature and extent of window openings where other buildings are in close proximity, and the construction and the nature of the openings in roofs. I am not a great believer in fireproof shutters to windows, as they are not always in good order and are probably never closed at the right time, nor can I say that wire gauze is likely to be a popular suggestion, as it obscures too much light and accumulates dirt. Nothing at present before us seems so good as the recently introduced wired glass, and I see no reason why its use should not be insisted on for the glazing of all roof lights and for such windows as are in opposition to others within 20 feet. This would be a most valuable step towards the consummation desired, and would probably be found in practice far more effective than is at the present time supposed. The increased use of automatic sprinklers is another means of reducing this hazard, and we should do all we can to encourage their introduction wherever a question of possible conflagration arises. Outside drenchers are not in use to any extent in this country, but doubtless very great protection would be derived from their more general adoption. The Fire Offices have already taken an important step in the direction of giving the public the benefit of their experience in the matter of fire-resisting buildings, and there is plenty of scope for us in trying to encourage the construction of new buildings in accordance with the regulations which have been drawn up. I do not know how far documents of this kind get into the proper hands, but I have frequently found architects and business people express surprise that they had never heard of any such regulations, so that apparently we do not do all we might in this matter of educating the public, who at the best can hardly be expected to have any expert knowledge of fires and their possibilities and the individual responsibility of each one to keep the annual fire wastage at a minimum point.

It would be inappropriate to conclude a paper of this nature at the present time without some reference to the recent Baltimore fire, and it may be of interest to state that Baltimore was a city

about the size of Glasgow or of Manchester and Salford combined, and, in regard to the general construction of its buildings, the width of its streets, and the character of its trade, did not differ appreciably from many British towns. The conflagration commenced on the 7th of February in the basement of a large six-storey building, known as the "Hurst Building," occupied as a wholesale dry goods warehouse. The cause is "unknown," but the fact that the outbreak originated near the elevator shaft probably accounts for its rapid development. The alarm was given about 10.30 on Sunday morning, and the fire appears to have almost immediately obtained a complete mastery over the Fire Brigade, having been beyond control one hour after the alarm was given, and before it was controlled it had extended over 150 acres, destroying 75 blocks bounded by wide streets with 1400 buildings thereon. The buildings in the area destroyed were for the most part constructed of brick, but a few had stone and iron fronts. In height they ranged from two to six storeys, although there were about a dozen so-called fireproof structures of 10 or 12 storeys, and it is remarkable that these withstood the fire better than those of medium height, as, although the contents were almost wholly destroyed, the structures are almost intact. The street separating the block in which the fire originated from other property varied from 55 to 66 feet in width, and although the side streets were somewhat narrow, the main streets of the city were broad judged from the English standpoint.

The Fire Department consisted of 432 permanent men and 18 Salvage men; the water supply was ample, with pressure varying from 50 to 100 lbs., and the hydrants were well placed and numerous. The appliances available consisted of 2 water towers, 27 steam engines, 2 chemical engines, 65 chemical extincteurs, and 35 hose carriages, and the building where the fire originated was connected by automatic alarm with the Fire Station, so that from this point of view the conditions were much more favourable than would be the case in this country.

The causes contributing to the spread of the fire were as follows:—

(*a*) An explosion, the cause of which is unknown, occurred on the top storey of "Hurst Building," and shattered windows in adjacent buildings to the north, east, and west, through which the flames entered.

(*b*) A second explosion of dynamite contained in a metal receptacle under the side walk close to the said building immediately followed.

The startling effect of these two quickly succeeding explosions appears to have disconcerted and temporarily demoralised the Fire Brigade.

(*c*) There was a high wind blowing.

(*d*) The extensive use of wood for cornices and for the embellishment of buildings.

(*e*) The numerous unprotected and mutually exposed roof and wall openings.

(*f*) An unwise use of dynamite, which, being applied on, or close to, already burning buildings, instead of stopping the fire, scattered burning material and flame in all directions into window openings, the glass of which had been broken by concussion.

In the course of the subsequent investigation many interesting and valuable facts with respect to the comparative resisting powers of various materials were brought to light. It may serve a useful purpose to place these on record.

The materials, whether used for exterior or interior construction, which most successfully resisted the fire were hard-burned brick and terra-cotta—90 per cent. of the brick and terra-cotta in the interior of the damaged buildings is available for re-construction. Wired glass in metal frames proved most effective as a stop, and, in the few cases where this material was used, no damage by fire to the interior of the buildings was sustained. Even wired glass in imperfect metal-clad wooden frames and sashes was more effective than imperfect metal-clad shutters. All classes of stone proved worthless when under the heat, and the loss on stone-faced buildings was total. Wired lath and expanded metal covered with plaster proved useless, as did imperfect metal-clad shutters. Iron stanchions, girders, &c., covered with fireproofing of terra-cotta, brick, or cement, suffered but little damage. Fireproof buildings, considered as fire stops, failed. The structures themselves, however, resisted the fire admirably, and, with few exceptions, the structural features remain practically intact and can be made effective for future use. On the other hand, all the contents and fittings, and the outside combustible ornamentation, were reduced to ashes. There were none of the true concrete or ferro-concrete class of structures within the area affected by the fire, but in minor instances where this material was used its fire-resisting qualities were satisfactory.

In one case where a building was protected by both outside and

inside sprinklers, the outside sprinklers being set in operation not only saved the building itself but stayed the spread of the fire in that direction.

The chief lessons to be learned from the conflagration are very much the same as those which I have endeavoured to bring out in this paper, and there can be no doubt as to the great importance of a public recognition of this ever-present conflagration risk if there is to be any likelihood of an improvement in the conditions, which are at the present time anything but satisfactory.

As a matter of interest I would like to read to you, in concluding, the following extract from one of the American journals, written after the Baltimore fire, which seems to so tersely deal with the subject that I may be pardoned for introducing it, although I greatly regret I cannot acknowledge the source from which it is taken, as the name of the journal does not appear on the copy which I hold:—

"Prominent, if not most prominent, is what in Insurance parlance is termed the 'exposure hazard.' By this is meant the likelihood of one building, no matter what its construction may be, to become ignited from a fire in a neighbouring or contiguous building. Statistical summaries of the causes of fire loss are not wanting. It is the consensus of opinion of the best authorities that between one-third and one-half of the total fire loss of this country, amounting to upwards of 200,000,000 dols. annually, is due to the results of this same 'exposure hazard.'

"In this connection it strikes me that the most obvious lesson to be drawn from the conflagration in Baltimore concerns itself with the fatal weakness presented by window openings in the outside walls of buildings, unprotected against the attack of fire from without.

"Buildings having brick or stone walls, when erected in accordance with the laws of any city in America, are of sufficient strength to withstand the attack of ordinary neighbouring fires, provided the outside window and door openings are made as fire-resistant as the walls they pierce.

"Such protection is thoroughly practical, and may be accomplished by either of two means—by iron shutters, or by wire glass windows in metal frames. Both types of protection are approved by fire underwriters, although wire glass windows are preferred by many on account of their obvious advantages. They do not require to be closed in a moment of emergency, being an integral

part of the building; they are not subject to corrosion, they are eminently sightly, and when made of polished plate are suitable for use in building fronts where iron shutters are quite inadmissible. And, above all, they offer a degree of fire resistance equal to the wall in which they were set.

"Had the buildings contiguous to the structure in which the Baltimore fire originated been provided with efficient window protection, there is every reason to believe that they would have withstood the contribution of flame until such time as the fire department could have controlled the original blaze. Taking fire almost immediately, however, the firemen's attention was diverted largely, and soon a conflagration which no human power could stay was in progress. This is the invariable history of conflagrations.

"It is quite idle to advise in a vague way the erection of 'only fire-proof buildings.' Their expense is such that many years must elapse before they become commercially other than the exception.

"What can be done, however, for not only new buildings but for buildings already erected, and at a cost comparatively small, so far as the results are concerned, is to provide every window and door opening with an efficient fire stop, so that fire in any one building may be confined therein.

"The question is not infrequently asked, 'Is it possible to erect a building that is thoroughly fireproof?' At the very outset it should be stated that the term 'fireproof,' in speaking of a building, is a misnomer. At the congress of fire engineers in London last year it was decided that the term 'fireproof' in the matter of the construction of buildings should be eliminated and that the term 'fire retardent' should be used in its stead. It was then justly stated that a great deal of harm has been done by the use of the term 'fireproof.' Turning to our question, then, 'Is it possible to construct fireproof, or, rather, fire-retardent buildings?' I say that the great conflagration which has visited Baltimore forever answers that question in the affirmative. This question is one of great interest to men who have wealth to invest in improved city real estate. These investments are dependent in their value on two things—first, the immediate income from the rents; secondly, the ability of the structure to withstand the effects of corrosion and intense fire. From the Baltimore conflagration it can be learned that in this city there were many buildings away be-

in construction, while there were others strictly up-to-date. It is perfectly well-known that in a conflagration such as visited this city everything combustible in a building will burn up. When a fire once gets beyond the control of a local fire department it becomes simply a matter of change of the direction of the wind or the amount of combustible material in the path of the fire to say what the extent of damage will be.

"There were several buildings in the recent fire which demonstrate the possibility of erecting fire-retardent structures. Even the Equitable building, the construction of which was not up-to-date, was not damaged, in my opinion, more than 50 per cent. If the steel construction is properly protected, with either hollow tile or concrete, the investment in large structures, if covered by insurance to 50 per cent. of the cost of the building, is a safe and profitable one."

THE CIVIC FIRE BRIGADE AND FIRE INSURANCE.

By JOHN LOUDON, Esq.

A Paper read before the Insurance Institute, Manchester, March 14, 1905.

Among the varied departments of Insurance life and activity which have received attention at the hands of representative exponents, the features and questions involved in Fire Insurance have secured conspicuous recognition. Sound, conscientious, and original work has been produced in adequate expression of complex problems and weighty responsibilities. It has been observed that Fire Insurance " has affinity with almost everything that goes to make up that entity called civilisation," and in perhaps no sense is this more evident than in the evolution of scientific research, which in its variability and adaptibility to industrial enterprise and, indeed, to all phases of life, constitutes ever-present and ever-varying elements in the adjustment of fire risk.

No product of the progress of the latter half of the nineteenth century is more fully, or truly typical, individually or collectively, of the interdependence of interests than that of Fire Insurance. By correlation of investigation, and relative appraisement of cause and effect, by the growth of new theories upon the failures or modifications of old practices, there has been slowly but surely raised monumental testimony to the solidarity of Fire Insurance.

The problem of the diminution of loss is of the first importance to those financial institutions, the business of which is to indemnify loss by fire. This is conspicuously manifest in the multiplicity of measures and conclusions, which directly and indirectly govern the acceptance of risk. Elements of judgment, however, in combination with unascertained contingencies, are antecedent to results which may, or may not, justify the adequacy of the consideration or premium required, for, in fire indemnity, we first make our charge and find the cost afterwards.

When we reflect upon the comprehensive efforts, the involved conditions and the administrative circumspection which

brought to bear upon, and are held to justify estimate of risk, as crystallised by specific tariffs, or determined within the field yet under the control of independent appraisement, we inductively recognise and confess how infinitely subtle and responsive are the variations which confront us. We endeavour to formulate opinion, construct a code, and perfect our practice commensurate with the circle of united experience. Adjustment of cause and effect, determining slowly, perhaps intermittently, but none the less surely, through community of motive and by fixity of purpose, the gauge of efficiency; and so it comes to be that the aspects and practice of Fire Insurance, like the histories and principles of progressive peoples, are continually being re-written and re-formed, and there is always room for further exposition according to scope and purpose.

Abstractly considered, and apart from Insurance, loss, by or by means of fire, may be defined as the measure, or extent of destruction, damage, and/or misfortune, direct or consequential arising therefrom, respective, and irrespective of the intrinsic or artificial values involved.

The preservation of property is absolutely essential to the preservation of the State. There is no greater nor more effectual means of destruction than that of fire. It is absolute, it cannot be re-instated, and the loss to the individual and to the community is definite and irredeemable.

Momentous as serious destruction of property is to owners in all classes of society, yet its grievous and paralysing effect in the case of multifarious industrial, commercial, mercantile, and agricultural interests, carries other and deplorable consequences. The position of the public can only be faintly measured by the number whose incomes have been arrested, plus the period of enforced idleness which may attend their misfortune, for who may fathom the ramification of privations which may, and in innumerable instances unquestionably, underlie serious disaster by fire.

Take the case of a modern well-built cotton mill, of, say, 60,000 mule spindles, by no means one of the largest mills in this class of fire risk; run by a Limited Liability Company, and doing a good class of business, on medium counts, in the Bolton trade. On an estimate of 25s. 0d. per spindle for buildings and machinery, &c., and allowing a fair amount for floating capital, a total capital is represented in round figures of

£100,000. Assuming that such a mill is insured against fire for an indemnity of £70, 000, that the very full allowance of 7½ per cent. is made for depreciation, and that 6 per cent. all round is realised as the trading margin; further, that the mill is totally destroyed by fire, and that circumstances warrant the full indemnity of £70,000 being paid ; also, that the mill takes nine months to rebuild without loss or gain in cost of re-erection, and forthwith is as profitable a concern as before. Assuming, therefore, the foregoing considerations, there would be a loss of profit to the firm of £4500, in addition to certain standing expenses of from £1000 to £1500, which on the lesser estimate would represent to the firm a total misfortune or shrinkage in their profit-producing power for the period of nine months of £5500. The loss in wages to the operatives would represent from £6500 to £7000—in all a direct misfortune to masters and men of, say, £12,000. No doubt a proportion of the employés might find work elsewhere, yet for the purposes of a concrete case we may assume, without exaggeration, that the estimate given affords a reasonable view. There is, however, reflex action on other individuals, for the deprivation of income ends not with the sufferings of those most directly interested, but extends to the community at large; to the shopkeeper and to the landlord, to the increase of workhouse relief, and to shrinkage upon the rates through unoccupied property. From the solitary instance cited, no great effort of the imagination is necessary to judge of the enormous annual loss to the nation's wealth, when we review the multiplicity of disastrous fires in this country yearly which secure indemnity, in the aggregate to millions sterling, from the Fire Offices.

While loss by fire in the sphere of economics has definite and far-reaching effect on the well-being of individuals, and on the prosperity of communities as the owners of property,—I use the term in its broadest signification,—there are in affinity reciprocal constituents, or elemental conditions which govern beneficially or prejudicially individual interests, and the common good.

The conditions affecting ignition, extent, and extinction of fire are relevant to the fact and measure of loss. Loss by fire is the resultant of convergent forces; the origin, development, and extinction being factors in the product, loss; and they cannot be dissociated from the consequences involved.

To indemnify owners of property against loss by fire is a legitimate business, a non-privileged trade, which, in this country and elsewhere, may be carried on by joint stock enterprise, or by societies under varying conditions of membership, but all having as their aim and object the acquisition of profit in some form, by furnishing security for the amelioration of loss; an indispensable public provision in the great majority of instances, and beneficent in all.

In the measure that this indemnity is valuable to the individual, it is beneficial to the State; and to secure this indemnity at the least cost to the citizen is to the advantage of the nation.

In the measure that effective public protection exists, to prevent and assuage necessity for relief by this indemnity, is to the advantage of the individual, and to the gain of the State; and it therefore follows that the efficiency of public protection is of economic interest to the community and of importance to the nation.

To certain natural and inevitable causes must be assigned the evolution of all sound administration, whether by the State or within the necessarily restrictive sphere of communities and individuals. This proposition is striking, and, indeed, obtrusive when viewed in true perspective, and is emphasised by minuter examination. Fire, although one of the most beneficent, is also one of the most destructive forces of nature. To prevent, limit, and quench its destructive power propounds a problem the solution of which rests with the individual, the community, and the State.

Germane to the problem has been evolved the business of Fire Insurance, which assuages the effects of, but cannot prevent, fire, nor can undertake responsibility for its extinction. But, as to the individual, to the community, and to the State, so to the Fire Offices, the questions of prevention, limitation, and extinction claim ever-present and ever-urgent contemplation. In the case of the interdependent interests of the individual, the community, and the State, irrespective of the existence or non-existence of such a business as Fire Insurance, the potentialities of fire as a destructive force involve self-protection. In the case of the Fire Offices, the possibilities of fire involve self-dependence. It may be submitted that, upon the true or false conception and recognition of these separate responsibilities, material interests

accrue, with loss or economic advantage to the State and to the Fire Offices.

To review the responsibilities of communities and the State, in their relationship to fire limitation and extinction, and to examine in some degree the principles and obligations of the Fire Offices as affected by these responsibilities, furnish the subject upon which I have been invited to address you—The Civic Fire Brigade and Fire Insurance.

It is not within the scope of my observations to deal with the historic or remote aspect of the question, extremely interesting though such a review would undoubtedly be, but, with such restrictive outline as a brief sketch may portray, to proceed to consider the salient features and facts which present themselves within the compass of modern times, and the present day.

In the early days of indemnity against loss by fire in the United Kingdom, days which now appear almost mediæval in their remoteness, the inception and annals of Insurance are characterised by much that is quaint and curious. Yet only so by contrast. We have little to-day in common with the past, and equally crude may our solutions of the problems of to-day appear to the intelligence and social forces of the future. As in those distant days, so now. The progenitors of our profession, exercised by considerations which affected the welfare of their business, and contending with the civic enlightenment of their day, undertook responsibilities which, by virtue of *custom*, have influenced the *legal* and public mind until the present time. While it is only the utterance of a professional truism to say that it is the business of Fire Insurance to pay losses and not to extinguish fires, yet, in the days which were unconsciously pioneering the enormous developments, and national importance, to which the business of Fire Insurance has now attained, the elementary law, the right of self-preservation, compelled the Offices, first individually and then collectively, to undertake the extinction of fire. This course, it is conjectured, was instituted in London by the Phœnix Fire Office (No. 1) in 1680. It is also premised that the first instance of fire engines forming the equipment of a Fire Office was in 1722, when the Corporation of the Royal Exchange Assurance notified the public that it had provided "several engines, with a sufficient number of firemen to work the

* The italics are the writer's.

engines, and watermen, *all clothed in yellow,** with proper instruments to extinguish fires, and a sufficient number of porters with bags, &c."—the latter service containing, no doubt, the germ or incipient principle of our modern Salvage Corps.

Gradually self-preservation, or protection, by means of fire-extinguishing equipment maintained by Offices was extended to those towns in the provinces where such Offices undertook business. The evolution of civic enlightenment, with its inevitable concomitants, revelation of duty, and recognition of responsibility, had, doubtless, a salutary influence upon many of the more alert and enterprising communities, influenced not a little, it is to be feared, from the fact that, the zealous services rendered by the firemen of the Offices were not infrequently attended by forms of jealousy, and an independence of action, which ran sadly counter to efficient aid and desirable results.

In 1824 the city of Edinburgh, influenced by such considerations, and by the experience of serious fires in the first six months of that year, established a powerful fire brigade of eighty trained firemen, with three large manual engines, a number of small engines, hand engines, and all other appliances, with Mr. James Braidwood as Superintendent.

In 1830 Mr. Braidwood published a book, entitled "On the Construction of Fire Engines and Apparatus, the Training of Firemen, and the Method of Proceeding in Cases of Fire." In the preface to this book it is interesting to note the following observations by Mr. Braidwood as suggestive of the paucity of information then accessible, in regard to so important an element in fire-extinguishing equipment as fire engines.

Mr. Braidwood says: "Not having been able to find any work on fire engines in the English language, I have been led to publish the following remarks, in the hope of inducing others to give information on the subject." The book is characterised by much that affords evidence of experience and minute study, conscientious and acute; and, in the light of latter-day practice, the reader is impressed with the sagacious and shrewd personality, whose bold, practical, and suggestive views were so soon to receive recognition by the Fire Offices of London in the responsibility of organising and directing their London Fire Engine Establishment.

It is curious to note, from the list of subscribers' names with which Mr. Braidwood's book closes, that Manchester is the only

* The italics are the writer's.

English town from which Fire Offices are chronicled as applying for copies of his work, the Offices being: The "Alliance," "Globe," "Guardian," "Manchester," "Norwich Union," "West of England," "Protector," "Phœnix," and "Royal Exchange,"—a goodly array, as against the apparent nonchalance of other centres; but doubtless, then as now, the premier industrial field had keen regard to efficiency in fire extinction.

The valuable Library of the Manchester Insurance Institute does not possess a copy of Braidwood's book. The work is honoured by many valuable quotations in that marvellous compendium, Walford's "Insurance Cyclopædia," and as the Manchester Insurance Institute is the parent of all kindred British and Colonial Associations, I have pleasure in asking, if I may, your acceptance of the copy I possess. The book is inscribed to a friend of Mr. Braidwood, and therefore carries the added interest of his signature.

After the long *régime* of a century and a half, the custom by the Offices of maintaining independent proprietary fire brigades was terminated in London in 1833 by instituting an organised combination styled "The London Fire Engine Establishment," and Mr. James Braidwood, "Master of the Fire Engines" of Edinburgh, was appointed chief. This organisation, purely proprietary in character and administration, was, in its rudimental ownership, the joint possession of ten Offices, the "Alliance," "Atlas," "Globe," "Imperial," "London Assurance," "Protector," "Royal Exchange," "Sun," "Union," and "Westminster." Each Office contributed, per annum, on the basis of respective Insurances in force within the metropolitan area, ascertained by the amount of Fire Insurance Duty collected—a Government tax, it may be observed, which under varying conditions had been imposed since 1782, and was not abolished until 1869. This concerted agreement, judicious in its mutually helpful and protective aspects, continued to gain strength by fresh accessions, and eventually the "Establishment" became the joint property of many of the Fire Offices.

It may not be amiss here to observe that Mr. Braidwood's life was sacrificed to the call of duty in the great Tooley Street fire of June 22nd, 1861, one of London's greatest conflagrations, which continued to burn for nearly two days, several weeks elapsing before it was finally extinguished, and which involved a loss of nearly £2,000,000, covered to a large extent by insurance.

In 1833 the Lighting and Watching Act (Section 44) conferred powers on parishes and districts in England to provide for fire-extinguishment. This Act contains the oldest general provisions now extant.

In 1834, on the 16th October, nearly two years after Mr. Braidwood's appointment as Superintendent of the London Fire Engine Establishment, the Houses of Parliament were destroyed by fire. This conflagration, calamitous by reason of historic association, and in regard to magnitude of property involved, deeply impressed the Offices with their inability to deal with overwhelming catastrophes. Within two months thereafter, a forceful communication by the Offices, through their Engine Establishment Committee, was addressed to the Duke of Wellington, at that time Chief of the Government, and was by the Duke sent to the Home Office.

In 1842 Liverpool, and in 1844 Manchester, obtained Parliamentary powers and established Fire Brigades. In the latter year, 1844, the "First Report of the Commissioners for Inquiring into the State of Large Towns and Populous Districts" was published, and in the following year the "Second Report" was presented to Parliament. In 1847, two years later, an important measure, entitled "The Towns' Police Clauses Act," was enacted. Under this Act (Sections 12, 32 and 33) it is set forth that districts or places to which certain other Acts are applied *may** provide fire engines and firemen, including optional powers to send engines, appurtances, and firemen, under specified limitations, outside such districts or places, with powers in such event to levy charges on owners of property receiving service.

Following this Act, Local Authorities in the provinces, gradually recognising their responsibilities under Parliamentary powers—by virtue of such, and special Acts in certain individual instances—organised Fire Brigades under varying degrees of efficiency and maintenance. The growing importance of some of the brigades throughout the country, and their increasing number, served to strengthen in the public mind the view that it was the duty of Fire Offices to pay for fire-extinguishment. This view was not unnatural by reason of legal assessments upon the Offices; the reimbursing by the Offices, of their insured, payments exacted for brigade services; and the deep impression—not then effaced—left upon the country as a whole

* The italics are the writer's.

by the long-standing custom of proprietary fire-extinguishing services, on the part of the Offices.

In 1862 a Select Parliamentary Committee was appointed "To inquire into the existing state of legislation, and of any existing arrangements for the protection of life and property against fires in the Metropolis."

Four years after the death of Mr. Braidwood, namely, in 1865, there was effected the Metropolitan Fire Brigade Act, providing that the duty of extinguishing fires in London, and protecting life and property in case of fire therein, be entrusted to the Metropolitan Board of Works; and in the following year, 1866, on the 1st of January, the Act came into operation. It may here be observed that, although the Metropolis had not been wholly dependent upon the Fire Offices for fire-extinction, yet such provision as did exist under parishes, and otherwise, subsequent to the provision of fire engines by the Offices, was of the most unsatisfactory character. Efficiency, worthy of the name, rested with the Fire Offices, but only in their own interests. The great fire of Tooley Street was the means of arousing public attention to the enormity of peril from fire, and compelled the Offices to realise how insufficient and necessarily limited were their own abilities to deal with stupendous conflagrations.

Unfortunately, the action of the Fire Offices in merging their London Fire Engine Establishment in the Metropolitan Board of Works, served to emphasise the legal status of responsibility of contribution for extinguishment expenses, pre-existing in some places in the provinces, for the Offices not only handed over their whole equipment and freehold and leasehold properties, valued at £30,000, without recompense, but they were coerced into consenting to a demand that they should contribute to the expenses of the Metropolitan Fire Brigade, and compromised this unjust pretension, by agreeing to pay an annual sum equivalent to £35 for each million sterling of Fire Insurances effected in the Metropolitan area. In the aggregate the contribution at that period yielded £10,000. This charge of £35 remains the unit per million of insurances, but the last contribution, namely, in 1904, amounted to £34,316.

The Fire Offices' Committee, constituted 46 years ago, had not, at the period when this compromise was made, as now, barristers

as chief executive officers, and it is reasonable to assume that had they had so, the amazing improprieties which fastened so oppressive and onerous a burden upon the associated Offices would not have been committed.

In 1867, by the Poor Law Amendment Act (Section 29), powers were granted to certain vestries for provision against fire.

In 1875, by the Public Health Act—which may be expressed as consolidating Acts prior thereto—Section 171 directs that "The provisions of the Towns' Police Clauses Act, 1847, with respect to the following matters" (namely, item 2 with respect to fires) "shall, for the purpose of regulating such matters in *Urban** Districts, be incorporated with this Act." Other sections applying to Urban Districts are 66, 163, 202, 233, 276, and 285.

The Local Government Act of 1894 contains no provisions relating to the prevention and extinction of fire, but has an important bearing, by reason of its relationship to certain alterations as regards Local Authorities, for executing the Lighting and Watching Act and the Poor Law Amendment Act, both already referred to.

In 1898 the Parish Fire Engines Act conferred powers upon "Parish Councils to make arrangements with an adjacent borough for the use of fire-extinguishing appliances."

Allusion has already been made to the special Acts obtained by Liverpool and Manchester. Some other towns have also secured special privileges, among which may be cited, Ashton-under-Lyne, Birmingham, Newcastle-upon-Tyne, and Salford. On the 12th April, 1899, Mr. Guy Pym, M.P., brought in a bill to promote the efficiency of Fire Brigades. With the exception of the Act of 1865 in favour of the Metropolitan Fire Brigade, no public bill, having for its object an exhaustive and compulsory code of Fire Brigade organisation, had before been submitted to Parliament. On the second reading of the bill it was withdrawn, and in the following year, 1900, a Select Committee was empowered "To inquire and report as to the existing arrangements for the provision of Fire Brigades (including both staff and appliances) in England and Wales, excepting the Metropolitan Fire Brigade; the adequacy of such arrangements for the due protection of life and property from

* The italics are the writer's.

destruction or injury from fire, and the amendments, if any, which are necessary or desirable in the law on the subject."

Having referred in the preceding, necessarily restricted, survey, to certain pertinent and outstanding circumstances bearing upon the extinction of fire and Fire Insurance, we now proceed to review the present-day conditions of public provision for the extinction of fire, and the Parliamentary powers which govern the public service.

The necessity for very concisely stating these powers shall, I trust, neither discount the importance of the principles involved, discredit the reality of the issues, nor disparage in any just sense their economic aspects. Parliament has, for many years, granted to Local Authorities, under general and special Acts, powers for the provision of public fire-extinguishing equipment, both as regards firemen and fire appliances. These powers are not *compulsory*, they are *permissive;* in other words, they confer, in varied degree, upon communities authority for the provision and maintenance of fire equipment, *if they be so disposed.* The public conscience, reflected by communities through Local Authorities, and not unnaturally elastic in its measure of enlightened judgment and recognition of responsibility, has in differing degree dealt and dallied with the duty of fire-extinction, with the result that there has now existed for many years three distinct courses of conduct, namely, communities who, by special Acts, have sought to amplify privileges and promote efficiency; communities who are content with the indefinite responsibilities of optional powers; and communities who, by virtue of non-compulsion, fail, evade, or decline to acknowledge any responsibility.

In organisations for the public extinguishment of fire, five all-important features are of interdependent interest—constitution, payment, degree of equipment, measure of efficiency, and, last but not least, water supply, without which the most efficient organisation is paralysed.

In regard to "constitution" and "equipment," provision may be summarised as follows:—

Police and Professional Fire Brigades.
Volunteer Fire Brigades.
Retained Fire Brigades.
Private Fire Brigades.

The Police, and Professional Fire Brigade, are organisations, in the former case, wholly or in part formed from the police force, notably in several prominent communities, among which may be cited Bristol, Liverpool, Norwich, Nottingham, Portsmouth, and Sunderland. In certain other large communities, such as the Metropolis, Birmingham, and Manchester, the Fire Brigade is professional, or a distinct organisation, formed of men trained in the duties of fire-extinction as a profession, in which the police take no part beyond rendering assistance to secure public order in case of fire.

Volunteer Fire Brigades, as a class, may be divided into two categories, "Purely Volunteer Brigades" and "Partly-paid Volunteer Brigades." In the case of the "Purely" Volunteer Brigades, engines and appliances are furnished gratuitously, the public being depended on for general support by contributions; and essentially so, from owners of property receiving service in event of fire. The other type of Volunteer Brigade, namely, "Partly-paid," accept contributions from the public, but, in addition, obtain support from Local Authorities by way of annual payment, customarily of insignificant amount; or by the gift, or grant in trust, of fire-extinguishing equipment. Fire Brigade organisations of the "Volunteer" class prevail largely throughout the provinces, dependence on such brigades not being restricted to small communities, as they form the provision afforded by the Local Authorities of a number of large boroughs.

Retained Fire Brigades are organisations which are formed by the Local Authorities from the citizens, and are customarily manned by artisans and tradesmen. The members of such brigades receive a yearly retaining fee of small amount, to secure their services when required. These institutions are organised by certain permanent officers, responsible for the training of the men and for general efficiency. In addition to the retained fee paid to the members, the firemen also obtain some slight remuneration for attendance at drill and at fires.

Private Fire Brigades, as the name indicates, are maintained by private or public establishments wholly in their individual interests, although under varying conditions and circumstances their services are available for public emergencies, especially so in the case of Dock Yards, Railway, and Military Brigades.

Having alluded to the four types of Fire Brigades provided for the public protection of property in this country, it is desirable

to review the adequacy and up-to-dateness of respective equipments.

In many of the important County Boroughs the Fire Brigades belong to the respective municipalities. The Brigades are, broadly speaking, efficient, and in respect to the latest appliances, to use a nautical phrase, are well found.

In the case of more or less populous suburban and outlying districts, in the immediate neighbourhood of large towns, there is, in many instances, either very inadequate public protection against fire, or no protection at all, reliance having to be placed upon the adjacent city or town for such help as the authorities may, legally or otherwise, be at liberty to afford.

As regards small towns, Urban and Rural Districts, fire-extinguishing equipment is of the most restrictive and unsatisfactory character. The following quotation from the Report of the Parliamentary Select Committee of 1900, on Fire Brigades, says: "Taking England alone, of 1025 Urban Districts (including County Boroughs and non-County Boroughs) there are 266 without Fire Brigades." It may also be observed that in the principality of Wales the public provision of protection against fire would appear to be generally of the most unsatisfactory character.

In regard to the huge manufacturing and commercial areas of Lancashire and Yorkshire, the Parliamentary Report tells a sorry tale. From it we learn that in the West Riding there are 140 Urban Councils, of which no less than 74, or over 50 per cent., are without Brigades, and seven Urban Councils without hydrants—a population of 400,000, and property of a rateable value of considerably over a million sterling, without protection in event of fire. Further, that to protect a total population of nearly 2,500,000, with property of a rateable value of over six millions sterling, there were only 56 Brigades. Lancashire reveals a similar state of matters. Out of 128 Urban Authorities, at least 39, or fully 30 per cent., have no Brigades. Urban Authorities, with a population of 227,000, and property assessed at nearly one-and-a-half millions sterling, have no protection in case of fire.

The position in regard to Scotland and Ireland differs in no fundamental respect from England and Wales. In the more important towns of Scotland—Aberdeen, Dundee, Edinburgh, and Glasgow, and of Ireland—Belfast and Dublin,

including other towns of lesser size in both countries, well equipped and efficient Brigades are supported by their respective Municipalities, while equipment and efficiency, in greater, lesser, or no degree, characterises many small towns in Urban and Rural Districts.

As an expression of opinion upon the public provision of fire-extinguishment, the findings of the Parliamentary Select Committee of 1900 are, with certain exceptions, *condemnatory in marked degree.* It is, perhaps, well to voice the Committee's conclusions in its own words. Referring to the larger cities and towns, in regard to which evidence was received, the Committee was of opinion that "The Brigades and other arrangements for dealing with fire are generally adequate, and in some of them are in a high degree of efficiency. That the custom which prevailed in certain large towns of sending Fire Brigades from populous places to outside districts, frequently many miles away, is not a *safe** one, seeing that it leaves these towns entirely unprotected during the absence of the Brigades."

"That in smaller places, in Urban and Rural Districts, fire arrangements, *where they exist,** are often inadequate, and that in the majority of these places and districts there are practically no arrangements at all for protection against fire."

"That there is no guarantee that Volunteer Fire Brigades possess *adequate** knowledge of the work of dealing with fire, or that they will be found *efficient** when called upon to act. Further, that the principle of entrusting the performance of a *public duty** to private and irresponsible persons is an *unsound** one, and that the results of the application of that principle in the case of Volunteer Brigades are *very unsatisfactory.*"*

"That for large and populous towns Fire Brigades, either 'police' or 'professional,' are necessary to secure adequate protection against fire."

"That for smaller places and Rural Districts, where the work is less, and cost a consideration, the 'Retained' system is the best available to secure protection in the most economical manner."

Some consideration is now necessary of the practice of Local Authorities with regard to attendance at fires and remuneration, where Fire Brigade organisations exist.

I shall refer to these features broadly, with due regard to the claims of our subject. An essential overlapping in the questions

* The italics are the writer's.

of attendance at fires, and remuneration, tends to superfluous reiteration, and any attempt at expanded detail would unnecessarily extend the scope of the present review.

In London, the cost of maintenance is of a triple character, namely, by levying contributions upon the Fire Offices under a fixed scale upon the gross amount of their insurances within the metropolitan area; by a contribution from the Treasury; and by a parochial rate chargeable with the poor rate.

In a number of large towns the cost of maintaining Fire Brigades is mainly defrayed from the local rates, supplemented by voluntary contributions from the Fire Offices, and by payments from outside Local Authorities, who have agreements by which they secure service in the event of fire. It may also be observed that it is not customary for *large* towns to charge for attendance within their boundaries.

The Parliamentary powers conferred on Liverpool, Manchester, and Salford secure, within the limits of their respective Acts, reimbursements from the Offices for outlay in attending fires. These towns, however, have commuted their liability by annual payments. In the case of Liverpool, the existing rate of contribution is £1500, in that of Manchester £2000, and in the case of Salford £400.

Apart from the powers obtained under special Acts, there is no obligation on the part of the Fire Offices under the general Acts to pay Local Authorities in England and Wales for fire-extinction expenses. That the Offices do so, in very many instances, is a purely voluntary action, and that they frequently yield to disbursements in discharge of unreasonable claims for services rendered is, unhappily, only too true.

In Scotland, the Local Authorities of Aberdeen, Dundee, Glasgow, and Greenock have power to charge owners and occupiers of property within their respective boundaries. Outside the boundaries of these towns, however, the entire expenses can be charged, with, in the case of Aberdeen and Glasgow, 25 per cent. additional, and 50 per cent. additional in the case of Greenock. Under the Burgh Police Act, 1902, Local Authorities in Scotland have no power to charge within the burgh, but outside they can claim from owners and occupiers of property the whole actual expenses, including a reasonable charge for engines and firemen. Local Authorities otherwise can secure payment out of the rates for fire-

extinguishing, in the same way as directed by the Towns' Police Clauses Act, 1847, and the Public Health Act, 1875.

In Ireland, the general Act applicable is the Towns' Police Clauses Act, 1847, and Public Health Act, 1875. In Dublin there is special power to charge £15 or whatever lesser sum is equal to one-half of the expenses incurred. Belfast is authorised, in regard to insured property in event of fire, to tax Fire Offices, and in regard to uninsured property, to tax owners and occupiers for extraordinary expenses incurred, but an understanding exists with the associated Offices as to the scale of charges.

Under special Acts, extraordinary expenses may be explained as expenses incurred for services rendered on attending fires, and for any consequential depreciation in the equipment of the Brigade. Such expenses, in the case of Liverpool, Manchester, and Salford, we have seen to be compromised by certain annual payments. Sundry other Local Authorities throughout the country have special power to charge for attendance, of which may be cited Ashton-under-Lyne and Newcastle-upon-Tyne. Oldham has no statutory power, but the associated Offices have agreed to recognise an understood basis of charges.

Parliamentary powers, except in the case of the Metropolis, are *not compulsory* in regard to establishing and maintaining Fire Brigades, and there is, therefore, *no obligation*, but while Local Authorities have abundant power to maintain an efficient Brigade out of the rates, yet, in event of such an organisation existing, and there being no special powers to the contrary, charges by Local Authorities cannot be enforced within their boundaries. Further, Bunyan, in his "Law of Fire Insurance," appears to be confirmed by legal decisions, when he says that "According to the usual rules of construction, the power to charge *beyond** the district negatived the right to charge *within** it." In a noteworthy case, carried to a successful issue at Westminster by the "Liverpool and London and Globe," in 1873, the opinions of Lord Chief Baron Kelly, and Barons Bramwell, Piggott, and Pollock, are of importance, and I cite their findings as affording a clear and incisive exposition of legislative intention.

In giving judgment, the Lord Chief Baron said that, in his opinion, "the Local Board could not charge for the use of fire

* The italics are the writer's.

engines, hose, apparatus, &c., for extinguishing fire which broke out in a house or mill within the district to which the Local Board extended. By the several Acts of Parliament the Board was entitled to make rates for certain purposes, amongst others, for providing engines for extinguishing fires. A rate for that purpose was imposed on all the inhabitants, but there was no mention that in the case of a fire at the place of a ratepayer a charge could be made for the use of the fire engine. *If the legislature intended** that they should be entitled to make any charge for services so rendered to *any of the inhabitants who had contributed to the rates,** they would expect to find an *express provision** to that effect, *but no such provision was made.** Therefore, the Board of Health had *no right to make any charge** for the use of the engine."

In Baron Bramwell's opinion "the Local Board has *a duty to perform towards the public,* and that *what was common property should be employed in extinguishing fires.*"*

Baron Piggott said "no provision was made in the Acts for remuneration to be made for the extinction of fires *within* the districts of Local Boards simply because *it has to be done at the joint expense of the ratepayers for the benefit of all.*"*

In Baron Pollock's view "it was admitted there was no express contract, and for a Judge to say there was an *implied** one would be contrary to the provisions of the Acts *and to principle.*"*

It therefore follows that to present Bills for Service *within* the boundary of Local Authorities, either directly to the Fire Offices, or, what is practically the same thing, to charge the Insured, who promptly apply to the Fire Offices for relief, should in both instances be resisted.

In regard to legislation granting power to Local Authorities, apart from special Acts, to charge for Fire Brigade services *outside* the boundaries, such is conferred under the provisions of the Towns' Police Clauses Acts, 1847, whereby "the owner of the land or buildings where such fire shall have happened *shall,** in such case, defray the actual expense which may be thereby incurred, and *shall** also pay to the Commissioners a reasonable charge for the use of such engines with their appurtenances, and for the attendance of such firemen."

* The italics are the writer's.

The term "Commissioners" is the appellation used in the Act to designate officials appointed to administer its provisions.

On two occasions the meaning of the word "owner" has been matter of litigation. The later decision, which reversed the earlier, was the case of Sale *v.* Phillips (1894). In this case the term, "owner," within the meaning of the Act,—Public Health Act, Section 4,—is defined as the owner of the rack rent. Consequently, where Local Authorities send their Brigade to a fire beyond their boundary, in which buildings are not in risk, the "owner" can be charged for attendance and proceeded against, notwithstanding the fact that he has derived no benefit. The tenant farmer frequently furnishes a case in point, for, say in the case of a stack of hay which has been destroyed by fire, if the tenant farmer is entitled to be indemnified by an Office, and that Office has no other qualifying interest, the tenant farmer is exonerated from paying the Brigade charges. So much for the law; the custom, however, has been for Offices to pay a reasonable charge if they are satisfied that benefit has accrued from the services rendered, and without asking the Office protecting the "owner" to pay any part of the expenses, providing the building, or buildings, have not been in jeopardy.

The term "reasonable charge" constitutes an important feature in Fire Brigade remuneration, in addition to actual expenses, when services are rendered outside the boundary. "Reasonable charge" is the statutory phrase, and is of peculiar interest to the Fire Office, by reason of its indefinite signification and elastic operation. The fire underwriter is well aware how widely divergent are the "reasonable charges" of Local Authorities, and the Courts are not without record, at the instance of the Fire Offices, in protest of inequitable and extravagant claims for attendance.

To review, for comparative purposes, the amounts expended on Fire Brigades of some of the largest municipalities in relation to the nature and volume of commercial and/or industrial risks within their administration and jurisdiction, would be, not without features of interest to the Fire Underwriter. As, however, these considerations would encroach somewhat excessively upon the limitations of time, I have, with some reluctance, relinquished details, and the more readily as they do not expressly affect the scope of our

subject. Exception, nevertheless, may be made for one observation. The necessary income for the maintenance of Fire Brigades is mainly secured on the principle of equality of assessment upon the rateable value. The Fire Brigade organisation is, therefore, maintained without regard to the value of property at risk, and it would seem only equitable that owners of property, to whom, on occasion of fire, the services of the Fire Brigade are of greater value, should be assessed on a principle of differentiation commensurate in some degree with the value of the property at risk.

The trend of modern thought in scientific taxation is not equality of payment, but rather equality of burden or sacrifice. The *services* rendered by municipal administration are on the principle of *equality* within the sphere of their jurisdiction, but in certain places within that sphere the value of property, residential and business, differentiates enormously, and some proportional graduation in annual contribution would seem to be equitable in local taxation, so far as the maintenance of Fire Brigade organisations are concerned.

Merchandise, under varying conditions of warehousing, also machinery, &c., to an enormous value under present provisions, escape contribution to the maintenance of Brigades. Local Authorities, by the adoption of proportional assessment, would secure an ampler income in favour of efficiency, by providing sinews of war adequate to the protection of all interests at stake, and at the same time vindicate their claim on a principle, the justice of which seems rational and sound. The suggestion may only be said to affect Fire Offices, as an incentive to Local Authorities to secure ampler funds towards providing efficiency in Fire detection and Brigade organisation, with reflex benefits of incidence in Fire rating to the community. This consideration apart, the question is fiscal.

Passing from the foregoing outlines of the distinctive features which characterise, under Local Authorities, existing conditions of Fire Brigade organisation and remuneration, it is expedient to refer to the all-important matter of water supply. It cannot be denied that the Legislature has not displayed solicitude for the will of communities, by granting important provisions for the supply of water on the occasion of fire. Local Authorities, possessing Waterworks, and Water Companies, are under obligations by statutory provisions to afford

the fullest facilities, and without charge, for fire-extinction, except in regard to private reservoirs, or other private sources of supply fed by them.

In the case of the Metropolis, the Water Companies are compelled by statutory provision to give facilities for the supply of water on occasion of fire. As regards the operation of general or local powers, the public provision of water is customary.

In principle, it is compulsory upon Local Authorities to provide water, exemption only being when they cannot do so. By the Towns' Improvement Act, 1847, Section 124, incorporated in the Public Health Acts, 1875, it is provided that "Every Urban Authority *shall** cause fire plugs, and all necessary works, machinery, and assistance for securing an efficient supply of water in cases of fire, to be provided and maintained, and for this purpose they may enter into any agreement with any Water Company or party." Another statute of the same year, entitled the "Water Works Clauses Consolidation Act," intended for incorporation by reference in special or local Acts (sought for after 1847), embraces the following important provision under Section 42, that: "The undertakers (that is the Water Company) shall at all times keep charged with water, under such pressure as aforesaid (namely, such pressure as will make the water reach the top storey of the highest houses within the district), all their pipes to which fire plugs shall be fixed, unless prevented by frost, unusual drought, or other unavoidable cause or accident, or during necessary repairs, and shall allow all persons at all times to take and use such water for extinguishing fire, without making compensation for same."

It is also proper to observe that Local Authorities are penalised under Section 43 of the same Act, "unless unavoidably prevented" should they "neglect to maintain such fire plugs, or furnish a sufficient supply of water for the public purposes aforesaid, or neglect to keep their pipes charged under such pressure as aforesaid, or neglect or refuse to supply any owner or occupier entitled under this or the special Act to receive a supply of water for any time for which rates have been paid or tendered."

It is difficult to say how far the Water Works Clauses Consolidation Act, 1847, has been incorporated by communities in

* The italics are the writer's.

their local or special Act. It is believed, however, to be generally so.

An interesting case, Atkinson v. Newcastle and Gateshead Water Works Company, raised the question as to liability for destruction of property by fire through neglect in furnishing the required pressure of water. Judgment, first in favour of the owner of the property destroyed, was, however, on appeal, reversed as "unreasonable and contrary to the true construction of the Act."

Many of our large towns own the Water Works and afford a public supply which is adequate on occasion of fire, and otherwise reasonably satisfactory in regard to statutory obligations. This may also be said partly in an equal, and partly in a qualified sense, of some other towns served by Water Companies; but it is to be regretted that, for fire-extinguishing purposes in a very large proportion of our communities, provision is inefficient, an opinion which, as Fire Underwriters, we have only too often had occasion to emphasise, and which (even occasionally in the case of our large towns), we feel, reflects severely upon local administration. As indicative of such features in their most unsatisfactory aspects may be cited the following observations from the Report of the Parliamentary Select Committee of 1900. The Report says:—"Taking England alone . . . . out of a total of 1025 Urban Authorities, 116 are returned as being without sufficient hydrants, and 119 as having a defective water supply. These unprotected districts have a total population of about five millions, and a total rateable value of about 1¼ millions sterling."

Adverting to the statutory provisions which confer on the public the free use of water, if taken from the mains in event of fire, it is difficult to understand why, if the same water be taken from a reservoir, pond, pit, or other such like place, fed through a meter by said mains, some Local Authorities should attempt to charge the Insured for the fresh supply sent through the meter. The water originally in the reservoir has by meter been paid for, or is payable, and on such the Local Authorities have their legitimate profit; but on service for fire, why should the water, upon which they have made their profit, be charged again, when it is only replaced? The genus meter has an unenviable reputation for inconsistency, but the principle, or rather lack of principle, in such instances would appear to fasten the stigma upon the meter's master.

A further apparent instance of the perversion of public privileges under Parliamentary powers may be named in the case of a popular theatre, within the jurisdiction of one of our great towns. In addition to ordinary private fire-extinguishing equipment, an installation of automatic sprinklers, in the interests of life and property, is fitted, but the essential standard of efficiency is unattainable by reason of inability to afford two independent sources of water supply. The Local Authorities, from a main, furnished one source of supply, but for certain structural reasons the owners of the theatre are unable to erect a water tower. Explanations, with a request for an additional source of supply from an independent main in another direction, a short distance from the theatre, were made to the Local Authorities, to which they replied that such a grant would be irregular and could not be entertained, as it might lead to a waste of water. It was pointed out that the property in question was a theatre; that a twin supply was to ensure efficiency for the sprinklers in case of fire, by providing against any possible failure of one source only; that the plea of waste of water was not relevant; and that in any case such waste of water, in the circumstances of the application, would only be, it was fervently to be hoped, of rare occurrence; and that efficient equipment in the protection of life, apart from saving of property, was of the first importance to the public attending the theatre, and consequently within the sphere of such safeguards as the Local Authorities could extend. The case was taken into consideration, with the ultimate decision that the Local Authorities could not see their way to depart from their customary regulations.

In the light of the duties of local administration and places of public entertainment, it would be difficult to furnish a more eloquent case in which Bumbledom with red tape can equally strangle the private effort of the ratepayer, the public sense, and its own intelligence.

But there is the other side of the picture, and the grotesque is furnished by the special powers of a great community, which, in providing for a reasonable charge for expenses by way of maintaining the Fire Brigade and for use of engines, &c., include "use of water for salvage purposes." That community unfortunately has not the services of a Salvage Corps to mitigate the evils of its fiery ways, and among the unascertained

predatory contingencies which disturb the mind of its Fire Underwriting fraternity, it would be interesting to know how far they are penalised by this mysterious "use of water for salvage purposes."

It is not within the scope of our review to enter upon any detail in regard to civic Fire Brigade equipment, but the purpose of our subject claims some observations as to the unity of views and practice, which obtain among the more prominent Fire Brigade organisations of the country. That some aspects of these views and practice should not always be in harmony with the views of Fire Underwriters cannot be matter for surprise, but when circumstances of professional expediency entail inquiry among important Fire Brigade organisations as to uniformity of practice, in certain accessories and features of work, involving heavy responsibilities and far-reaching consequences, it is matter for grave concern that there should be widely divergent judgment, indefinite knowledge, or no opinion at all. "If they do these things in a green tree, what shall be done in the dry?"

That the Fire Brigades of a considerable number of our great commercial and industrial communities are characterised by a high order of intelligence, and pre-eminent degree of efficiency, are matter of common knowledge to Fire Underwriters; and to bear tribute to the well-defined views of the Chiefs of Fire Brigades and their progressive adoption of methods and appliances calculated to obtain valuable economic results, is at once a duty and a gratification.

It is also proper to mention the National Fire Brigade Union, an association which exists in the interests of Fire Brigades in this country, and which has done useful work in promoting efficiency by expert training and the dissemination of experience and kindred information.

The Fire Prevention Congress also, by its community of purposes and by its meetings, is doing good work in directing public attention to the national necessity of fire prevention and protection; also by affording international opportunities for the exchange of views and practice, by which the diffusion of expert knowledge is advanced and efficiency promoted.

Although the scope and purpose of our subject is confined to Great Britain, it is no less a duty than a pleasure to acknowledge, as Fire Underwriters, our sense of obligation to our American

cousins for much that is valuable in promoting efficiency in Fire Brigade organisations and appliances.

In the preceding observations some attempt has been made to accurately ascertain, with such measure of completeness as the limits of an address will permit, the nature of the facts which govern the Civic position of communities and Fire Protection, and our final step is to consider the relation in which these facts stand to that vast system of economic enterprise — Fire Indemnity. That relationship is crystallised in a phrase which I borrow from our old and valued friend, the "Post Magazine." "Fire Prevention, Fire Protection, and Fire Insurance may be regarded as the three component parts of one homogeneous whole, and their mutual dependence cannot be too clearly recognised." The phrase is pregnant with lucidity of deduction, and re-states the propositions with which our observations commenced — the interdependence of interests, or solidarity of Fire Insurance.

We have traced the evolution of Civic enlightenment through the "fire" of experience, and by Parliamentary inquiry and legislative enactment have observed an ever-increasing sense of the responsibilities devolving upon communities and local administration. Our attempt is now to advance upon the sustained, if slow, albeit definite grasp by the Fire Offices of their true status in the economic activities and well-being of communities; and to re-state the evidences we have recited in the light of modern thought.

It has been shown that the protection of communities from serious loss by fire, in so far as Local Authorities generally have recognised their responsibilities, has far from reached the final goal of development, and so long as this is so, must criticism and public education, by readjustment of practice, be the means open to the Fire Offices by which to secure economic advantage to themselves, and thereby compel the public recognition and adoption of principles and methods which influence beneficially the individual interest, the common good, and the prosperity of the State.

The competency of this reasoning is denied by public sentiment, which it is only fair to the community at large to measure by their lack of interest in, or knowledge of, those fundamental truths which govern the distinction between civic duty as regards provision against fire, and fire indemnity as a

trading commodity; and it is to be regretted that, notwithstanding the severity of the strictures contained in the conclusions of the "Parliamentary Committee of 1900," as "*to the performance of a public duty*,"* the Committee should recommend "that Fire Insurance Companies should be required to contribute some portion of the expenses connected with fire-extinction." The public sense, and the Insurance understanding, labour under unhappy disqualifications; the former by lack of perception of the first principles governing indemnity, and the latter by reason of the incipient errors incidental to early enterprise, and subsequent lack of judicial safeguards, until the law, by right of custom and precedent, denies to the Fire Offices the validity of relief from burdens which are at once inequitable, and, in the interests of the State, subversive of sound economy.

The comparative study of the question as affecting the community and fire indemnity, is singularly suggestive in the light of *Powers* for fire protection conferred by statute, and *provision* by Local Authorities as revealed by the Parliamentary Inquiry of 1900. In the Report of the Select Committee, we learn from their summary of conclusions, "That the present statutory enactments for providing against fire are insufficient; that they are so frequently and so mixed up with, and incidental to, important Acts of Parliament dealing with totally different subjects, that they are liable to lose their force as fire legislation.

"That the inadequate provision against fire, shown to exist so largely throughout the country, is due sometimes to apathy on the part of Local Authorities, sometimes to ignorance or doubt (caused by defective legislation) on the part of such Authorities as to the powers they actually possess, and frequently to undue reliance on outside help."

Surely these conclusions form an indictment sufficiently strong, and afford a stimulus sufficiently powerful, to constrain communities through their Local Authorities to recognise the economic waste such a parlous position involves, and that the measure of that waste affects the purchase price of fire indemnity.

Reverting to the Report of the Select Committee, we find from the summary of their recommendations "That an Act of Parliament should be passed repealing all previous Acts, so far as they relate to fire, and conferring on Fire Authorities well-defined powers to provide Fire Brigades, and to make such other

* The italics are the writer's.

arrangements for protection against fire as they may deem necessary.

"That the Local Authorities of cities, county and non-county boroughs, and urban districts (defined in the Report as 'populous places') should be the constitution for Authorities for those places, and that rural district councils should be the constituted Fire Authorities for dealing with fires in villages, hamlets, and in all other parts of the country, except 'populous places,' but that provision should be made to enable any parish council, having regard to the size and population of the parish, to be constituted a separate Fire Authority.

"That in order to ascertain the extent of the loss of life and property occasioned by fire, Fire Authorities should be required to send to a Government Department full particulars of all fires as they occur, and that annual reports should be published containing the information so obtained."

As Fire Underwriters, we cannot but welcome all such legislation, and it may be that our position enables us the more fully to grasp how imperative are such reforms, in the interest of the public weal and national good; for, under the daily vision of the true perspective, we realise that the cost of fire indemnity, like water, finds its own level, and that the price to the community is the measure of results, however these results may be attained. Looking at the question before us in the light afforded by the daily experience of practical men, it is of emphasised interest to turn to the shrewd and pointed observations of Mr. James Braidwood, in his book, to which allusion has already been made—observations which, after the lapse of three-quarters of a century of civic enlightenment, tell with force little less than in the days when they were written. He says:—"It has often been to me matter of surprise that so small a portion of the public attention should be directed to the matter of extinguishing fires. It is only when roused by some great calamity that people bestir themselves; and then there is such a variety of plans proposed to avert similar cases of distress, that to attempt to concoct a rational plan out of such a crude, ill-digested, and contradictory mass of opinion, requires more labour and attention than most people are inclined to give it, unless a regular business is made of it."

After some observations relative to the benefits to be derived

from the principle of centralisation, Mr. Braidwood says:—"*Any particular circumstances** occurring at a fire would thus be immediately reported, and the advantages of any knowledge or experience thus gained would be disseminated over the whole kingdom. As the matter at present stands, one town may have an excellent Fire Engine Establishment, and another within a few miles a very indifferent one, and, when the one is called to assist the other, they can neither act in concert, nor can the apparatus of the one in case of accident be of the smallest service to replacing that of the other. The best might, if a proper communication be kept up, be under frequent obligation to the worst, and here, as in other matters, it is chiefly by communicating knowledge that it is increased. If the whole experience of the country were brought together, and maturely considered and digested by *persons competent to judge*,* I have no doubt that a system might be introduced suitable to the nation and the age in which we live. Instead of hearing of the 'dreadful losses by fire,' and the 'great exertions' made to extinguish it, all the notice would be, such a place took fire, the engine arrived, and it was extinguished."

Perhaps we are tempted to smile at the result anticipated, but it must be with the kindly feeling which governs "the wish that is father to the thought," for, in the views quoted, we must own that in large degree the deliberate judgment of to-day yet finds salutary cause for reflection.

The business of Fire Insurance, as a form of commercial enterprise, takes its place among the potential activities of the Capital and Credit of the nation. It differentiates among the citizens in reciprocity of interests, as the exchange provides what the other wants. As a form of commercial enterprise it is carried on to make profit by the sale of a security, subject to terms of contract, called Fire Indemnity, for procuring which the buyer is charged, according to appraisement by the seller of the security sought; the process by which the price is arrived at being an arbitrary right on the seller's part so far as the public is concerned, and which the buyer is under no obligation to accept.

The business of Fire Insurance is in no sense privileged. As ratepayers the annual aggregate disbursement by Offices transacting the business of Fire Indemnity in the United Kingdom

* The italics are the writer's.

is very great. Of this there is ample testimony from a partial estimate which has been compiled with care. I refrain, however, from giving any approximation, by reason of my inability to complete the estimate at the present time. I may observe, however, that, including the Metropolis and the provinces, the Home and Foreign Fire Offices have about 600 places of business in this country. Co-equal with other traders and ratepayers, Fire Insurance has its legal status, and with other legitimate trades is entitled to participate in such benefits or services as may accrue from the expenditure of Local Authorities; and it is as inequitable to charge Fire Offices for Brigade services as it would be for Local Authorities to assess medical men for arresting a plague; or Life Offices for reduced mortality by reason of improved sanitation; or Employers' Liability Insurance for ambulance work; or Burglary Insurance for the services of policemen.

The evolution of civic enlightenment demands, in provision against fire, certain safeguards for the common good, and the law has furnished the necessary powers, but there is no Government control, and without such it is difficult to see how legislation can be effective. Though Parliament, however, has not so far deemed it necessary to make compulsory the powers they have granted to Local Authorities for provision against fire, yet it has not hesitated in some instances to amplify these powers, to the extent of enabling Local Authorities to impose upon the traders in Fire Indemnity charges for a civic duty, which in equity with other traders and ratepayers, the Fire Offices have no right to bear.

In law there are many rights and obligations which are well recognised and established, and which would nevertheless have never existed but for the careless or generous action of prior owners, such as rights of light, rights of way, &c. Such rights, when once established, cannot be got rid of otherwise than by release or agreement. The Fire Offices are to-day in a similar position owing to their past laxity and generosity.

How alert the great "interests" of the country, railway, gas, water, telephone or electricity, are to the slightest, or assumed interference, with their rights! How these great "interests" fight and defend themselves upon the presentation of even the most innocent-looking bill! Therefore, it is matter for con-

gratulation that one of the most gigantic and beneficent of enterprises—Fire Insurance—is now, through the legally qualified Executive Officers of the Fire Offices' Committee, equally forward in watching its status in the social economy, by such procedure as may be desirable or necessary, to safeguard its interests. Valuable services have thus been rendered, but relief from existing burdens is worthy of strenuous effort, for these burdens are the basis of recommendations in the Report of the Parliamentary Committee of 1900, which, if legalised, will very greatly add to the oppressive character of those already carried.

The special statutory powers granted to certain Local Authorities, and the Metropolitan Fire Brigade Act, 1865, are very bad precedents so far as the Fire Offices are concerned, because they imply that the Fire Offices, before the conferring of these powers, have, in effect, recognised their liability in regard to fire-extinguishment, or else they would never have handed over gratis, as in the case of London, assets of considerable value, and assented to an annual payment towards future expenses. Prior to the granting of these powers, offices were under no legal liability, and it will now be very difficult to overcome bad precedents, which have since been acted upon by extending the principle to other towns, and which, coupled with the recommendation of the Parliamentary Committee, "That Fire Insurance Companies should be required to contribute some portion of the expenses connected with fire-extinction," are a menace to the business of Fire Indemnity and an invasion of its rights.

Keen competition, evinced by assiduity and honourable rivalry in the business of Fire Indemnity, has much to do with the doctrine of expediency which tolerates the existing state of affairs; for it is to the lack of definite and sustained refusal by the Offices, under all conditions, to pay for "extinguishment," that public opinion is strengthened in the erroneous views it holds as to contribution being the duty of the Fire Offices.

As the Offices contend that it is equitable to classify their business, and in practice widely confirm the principle that the misfortunes of one class should not be charged to another, so is it equally equitable that there should be some well-defined code, or standard, of efficiency, in the character of public fire-extinguishing organisations, and that such places and districts as fall short of the requirements of prescribed safeguards be penalised in rating accordingly.

The existing wide-spread chaotic condition of provision against fire, well known to Fire Underwriters, and crystallised in the late Parliamentary Report, shows existing legislation for fire-extinction to be, for lack of compulsion, neither safe nor just; for, in ill-defined legislation, and irresponsible provision or neglect, the resources of the nation are depreciated.

It is unnecessary to enlarge upon the principles which govern the cost to the Insured of the indemnity he secures. While the details which equitably fix the price of that indemnity are the province of the Fire Underwriter to determine, the broad principles which regulate the economic aspect of compensation are within the grasp of the most ordinary intelligence; and it is amazing that at this period of civic enlightenment and advanced legislation there should be room for doubt, or grave discussion, as to whether or not it is to the advantage of all communities, in their multifarious districts and complexions, to compel their Local Authorities to provide efficiency in water supply, equipment, and trained men for the prompt arrestment and suppression of fire.

A question of such national importance very naturally and strongly suggests that provision for fire-extinguishment should be under the control of a department of the Government. Such a departure, it may be conjectured, would create a code, and a standard, differentiated to equitably and efficiently meet the need of all places and districts. A system of periodical inspection by experts would necessarily be embraced; an independent bureau for information and statistics would doubtless be included, invaluable to the public and to the Fire Offices; and facilities for the impartial investigation of circumstances attending fires would be at command in the interests of trade and the State.

In conclusion, I am constrained to observe that I have only dealt with a phase of the subject under review. The responsibilities of civic authorities in regard to automatic detection of fire; of gas and electricity on the outbreak of fire; and the checks and other benefits which would accrue in all great centres of commercial and industrial activity from Salvage Corps as the servants of the Fire Offices, are, with other matters, eminently important in their relationship to the Civic Fire Brigade and Fire Insurance.

COCOANUT FIBRE AND MATTING FACTORIES.

By F. F. WORTHINGTON, Union Assurance Society.

A Paper read before the Insurance Institute of Newcastle-on-Tyne, February 24, 1905.

THE manufacture of cocoanut mats and matting does not at first sight seem a very appropriate subject to bring before this Institute. As a matter of fact, we have only one risk of this description in our district, and the industry itself, although an important one within certain limits, is not of the widespread importance of linen, cotton, flax, jute, or any of the other textiles. The reason for this is that the goods manufactured are, by the nature of the material used, of a durable character, and the demand for them is necessarily very restricted. The number of factories, consequently, is small; they are most numerous in the neighbourhood of London, and are rincipally to be found in the counties of Norfolk and Suffolk, many being in or near the towns of Long Melford, Sudbury, Lavenham, Hadleigh, and Glemsford.

All these places lie within a few miles of one another, and the factories have been established for many years, and are still carrying on a thriving and prosperous business. It is a curious coincidence that there should be such a number in this district, and I am unable to offer any explanation of the reason for this particular locality having been selected as the home of the industry, unless it is the fact that labour is cheap and fairly plentiful.

As I shall explain later, nearly all our supplies of raw material are imported from abroad, and it will be necessary for me to deal briefly with the sources of supply, mode of production, and other matter cognate to the subject which I think may be of interest.

Locality, Cultivation, and Characteristics. The cocoanut palm, from the fruit of which the valuable coir fibre of commerce is obtained, is botanically described as a pinnate leaved palm, with a straight or often gracefully curved stem marked by annular scars, cultivated throughout tropical India and Burma, especially near the sea coast. On the eastern and western coasts it is particularly abundant, more so towards the south.

There are several cultivated varieties, but all flower in the hot season, the nuts ripening from September to November.

Although found considerable distances inland, the cocoanut palm is essentially a plant of the coast, and luxuriates on the islands of the Indian Ocean. The India region of the cocoanut may thus be said to be the lower basins of the Ganges and the Brahmaputra, and the Malabar and Coramandel coasts. In the Brahmaputra valley it ascends to a greater distance from the sea than in that of the Ganges, but in both it is an introduced tree, as it nowhere occurs in forests far away from human dwellings.

On the Malabar coast and on the islands off the coast of India it may be different, but even in these localities it rarely exists as a forest tree, although it is self-sown. It is also stated to be abundant on the Laccadive Islands and on the Nicobar group, in the bay of Bengal.

This noble palm requires an atmosphere damp with the spray and moisture of the sea to acquire its full stateliness and growth, and loves to bend over the rolling surface, and to drop its fruits into the tidal waves. Wafted by the winds and currents over the sea, the nuts float along without losing their germinating power, like other seeds which migrate through the air, and thus, during the lapse of centuries, the cocoanut palm has spread its wide dominion, from coast to coast, through the whole extent of the tropical zone.

We are informed that in India alone there are 480,000 acres under the cocoanut, and this, if we reckon the number of trees per acre at 120, which is rather under than over the mark, gives us a total of nearly 58 million trees. These figures, which may be taken as fairly accurate, will perhaps give you some idea of the economic importance of the cocoanut palm to the natives of India, and also as an article of commerce.

Although I am only dealing to-night with one of the pro-

ducts of the cocoanut palm, it might be as well to mention, incidentally, that there is no single part of this wonderful tree that does not possess some special value.

The sliced kernel, dried at ordinary temperatures, either in the sun or artificially, contains some 30 to 50 per cent. of oil, and this oil has now for many years been largely used in the candle trade. Of no less importance is cocoanut oil to the soap maker. It forms a hard and very white soap, more soluble in salt water than any other kind made on a commercial scale.

The green fruit, the flowers, and the water or milk from the green nut are all used as medicine for various complaints by the native doctors in India.

The cocoanut also yields a juice from the flowering spike, which may be drunk in its fresh state—toddy; or fermented and distilled—arak; or boiled down to sugar and eaten as—jaggery.

The stem of the tree is said to yield gum, while the whole or every part is claimed as a dye ware, especially the husk enclosing the fruit, and the foot stalks of the leaves.

The wood is commercially known as "Porcupine Wood." It is used for rafters and ridge poles, house posts and other building purposes, for spear handles, walking sticks, and fancy work.

This by no means completes the list of products from the cocoanut palm, and I have only mentioned these to briefly indicate that the production of coir fibre does not exhaust its usefulness.

I do not propose to dwell at any length upon the cultivation of the cocoanut, as such matters as sowing, transplanting, and treatment of plantations do not fall within the scope of this paper, but it may interest you to know that the cocoanut throws out a spathe and a leaf every month, each flowering spike yielding from 10 to 25 nuts. The produce of a tree in full health and properly tended may be from 50 to 120 and even 200 nuts a year to each tree in full bearing. The cocoanut will continue to bear for 70 or 80 years.

Each of these nuts is, of course, the fruit, which has an outer covering in the shape of a course fibrous husk. It is from this fibrous husk the fibre or coire is obtained. By the way, the name "coir" is said to be derived from the Malay "Kayar" (from the verb "kayaru," to twist), through the Portuguese corruption, "coiro."

This coir fibre has been found suited for the production of

a variety of articles of great utility and elegance of workmanship —table mats, fancy baskets, bonnets, and many other things.

Instead of being formed into rough cordage only, and mats made by hand, by means of ingeniously constructed machinery the fibre is rendered sufficiently fine for the loom, and matting of different textures and coloured figures is produced, while a combination of wool in pleasing designs gives the richness and effect of hearthrugs and carpeting.

Brushes and brooms for household and stable purposes, matting for sheepfolds, pheasantries, and poultry yards, church cushions and hassocks, hammocks, clothes lines, cordage of all sizes, and string for nurserymen and others, for tying up trees and other garden purposes, nosebags for horses, mats and bags for seed crushers, oil pressers, and candle manufacturers, are only a few of the varied purposes to which the fibrous coating of the cocoanut is now applied.

Both the fibre and the rope were first exported to Europe about the middle of the sixteenth century: at that time the fibre was probably only used for stuffing mattresses and cushions, and it was not until the great International Exhibition of 1851 that coir ropes and coir matting attained a commercial importance in England.

Although a considerable amount both of fibre and yarn is exported from India, the article, taking India as a whole, is obtained chiefly as a bye product. It is accordingly inferior in quality and colour to the special coir obtained from Cochin, the Laccadives, Madras, Malabar, Ceylon, and Singapore. Locality seems to exercise a considerable influence over the quality of the fibre, soil, climate, and proximity to the sea being important influences. But there would seem to be other considerations, and, from enquiries I have made, there is very little doubt that certain varieties or cultivated forms of the cocoanut are better suited than others for the production of coir. A great deal depends also upon the collection of the fruit at the exact time the fibre is mature, and this, followed by an accurate system of steeping, beating, and cleaning the fibre, completes the manipulation calculated to produce the superior qualities of coir.

The fibre appears in the market in various degrees of fineness, depending on the age at which the cocoanut was cut and husked, and the care bestowed in steeping and cleaning. The commoner and coarser fibre comes from the old nuts. I believe this coarse

fibre is known in the trade as "Coconada," and which, as I shall explain later, is used in the weft of the commoner door-mats. The Cochin is usually the purest in colour, and consequently fetches the best price.

So far as cocoa fibre factories (for removal of the fibre from the husks) are concerned, they may be said, for all practical purposes, to be non-existent in this country, there being, I think, only one firm engaged in the trade at the present time.

Manipulation of Husks and Fibre.

The cocoanuts that are shipped here from Ceylon and the West Indies mostly arrive with the husks on. The removal of the husk from the shell is effected by means of two fine-pointed steel chisels, and it is said that a practised workman can in this way deal with about 1000 nuts a day. The nuts themselves, after being thus stripped, are generally sold to dealers, who in turn supply the retailers, costermongers, and others. The husks are then taken to the fibre mill, where they are treated for the removal of the fibre. They are first soaked in large tanks for several days; and I gather that this soaking of the fibre is a matter of considerable importance, as if continued too long the fibre will be weakened, and if it be curtailed the subsequent extraction and cleaning of the fibre will be rendered more difficult.

After the husks have been soaked they are put through massive iron fluted rollers to break the hard back bone, as it is called in the trade. They are then "milled" by being put through a drum studded with steel teeth, the snout of the husk being held by the workman and drawn out again with the long brush fibres on, the teeth having shredded the softer fibres from it, also the refuse or cellular tissue in which the fibre is embedded.

This brush fibre is subsequently dried in an air-tight drying room, and when dry, combed or hackled, tied up in bundles, packed in bales, and sold to the brush-makers.

To return to the softer fibres, these being the material from which the mats are made. When they leave the mill they are placed on an endless running belt, and so carried and dropped through a hopper into a screen, which has a spindle with iron beater attached running through it. These beaters are used for the purpose of removing any refuse still left adhering to the fibre; the refuse is then dropped on to another endless band,

and by this means carried out of the milling shop into the open yard.

The process of extracting the fibre is a wet one in all its stages. This refuse is an important article of commerce, as it is largely used for plant-raising and other purposes. When the fibre leaves the mill it is taken to the drying room, and when dried is baled up and sent to the matting manufacturers.

Before I leave this part of my subject and proceed in natural sequence to the actual manufacture of the fibre and yarn into the finished material, I should like to refer briefly to the methods pursued in the separation of the coir in India.

Naturally it is a hand process throughout, no machinery of any description entering into the operations. The husk is removed from the shell by forcing the nut upon a pointed implement stuck into the ground, and so expert do the natives become in this that they can clean many hundreds of nuts a day. The next process is that of soaking, as already described, and subsequently, of course, the separation of the fibre from the husk. This is done by hard manual labour, the separation of the fibre being effected by means of heavy truncheons. The cellular substance, or refuse still adhering to the fibre, which is so easily removed by the heavy beaters at the fibre factory, is disposed of by means of rubbing between the hands.

The proportion of clean fibre obtained from the nuts varies much—it may probably average 140 to 160 lbs. of fibre from every 1000 nuts.

When quite clean it is arranged into a loose roving preparatory to being twisted, which is done between the palms of the hands in a very ingenious way, so as to produce a yarn of two strands at once.

It reaches the manufacturers in England after the separation of the coir in India. The fibre is, as a rule, compressed and wrapped in an outer covering of sacking, every bale being marked on the outside with certain signs which indicate the quality and description of the fibre contained in the package, and the port of origin. The yarn having been passed through the hydraulic press and secured by bands of hoop iron, is marked in a similar way.

Both the fibre and yarn are sold by public auction in London, this being the principal port of entry.

No special provisions are made for the opening of the bales

of fibre and yarn, except that the former are generally opened in the building used for the storage of the fibre. The iron bands around the bales of yarn are struck off in the open yard, and the material requires very little manipulation to be ready for use. No elaborate machines, such as we see in jute factories, are necessary where special bale openers, and even steam hammers, are used for this purpose. The yarn is conveyed to the Bleaching House, where it is immersed in steam-heated vats containing sulphuric acid and bleaching powder. It is subsequently hung on timber racks in the open air to dry.

To return to the fibre, after it has been removed from the bales it is taken to the Teazer House, where it is passed through a machine very well known to Insurance men as a "Teazer" or "Devil." In most of the factories I have seen, this operation is performed twice; the machine itself being of very simple construction, generally consisting of a wooden drum or cylinder, whose periphery is coated with steel teeth, which when revolving catch the material and separate the fibres, at the same time removing any pieces of cellular tissue that may be adhering.

I would here remark that the fibre itself is singularly clean and free from dust or dirt. After the material has been teazed and the fibres well separated it is then ready for the weavers, although a certain portion passes through the Dye House. There is a considerable amount of dyeing done at all cocoanut matting factories, both the yarn and fibre being treated in this way.

Mats and Matting Manufacture.

In order to follow the manufacture of mats and matting, I will take them in order and describe as accurately as possible the process in each. Practically there are only four kinds, which may be described as wool-bordered mats, door-mats, open sinnit mats and matting, but there are, of course, many varieties of each of these.

The wool-bordered mats are made, as a rule, upon small handlooms of very simple construction, and the warp of these mats is of linen and the filling or weft of jute. These are the only mats in the manufacture of which any other material is used except the coir fibre itself.

The operative sitting at the loom has a heap of loose fibre at the left hand, and small pieces of first the wool border and then the fibre are twisted into the warp, and the fibre is trimmed off with an ordinary pair of shears as the process proceeds,

the loose ends of fibres being thrown on the floor alongside the worker. None of the refuse is wasted; it is subsequently used in the manufacture of the rougher kinds of door-mats, known in the trade as "Dirt Frighteners."

When the wool-bordered mats are taken off the looms they are generally, in a long strip of six or more, connected by the linen warp; they are still far from finished, and they have yet to pass through the Finishing Room, where they are bound, the design cut round with hand shears, and put through the combing machine to remove all loose fibre, and the shearing machine to make them level.

The door-mats are of two kinds—the better class are made entirely of coir yarn, sometimes on upright frames, on which the warp is stretched, the weft being passed through by hand on hand-looms and also on power-looms. Many of the highest quality are made on the upright frames, and the method of working the yarn on the warp is very interesting and ingenious. The making of door-mats on hand-looms is on precisely the same principle.

The mats known as "Open Sinnit" are made entirely of plaited coir yarn of varying degrees of thickness, and by the use of dyed yarn very pleasing designs are produced. These mats are made entirely by hand, the work being done on an ordinary table. The edge of the mat is pegged down to the table by steel pins, and the worker proceeds to fill in the middle to the required design, sewing the plaited fibre together in a series of loops by means of thin yarn threaded on an ordinary packing needle. At first sight the labour would seem to be very arduous, but it is extraordinary with what celerity a practised workman will complete one of these mats, from six to eight hours being sufficient for a mat of intricate pattern measuring 3ft. by 8ft. The needle, of course, is necessarily kept very sharp by means of occasional rubbing on a hone, and passage through the tough, thick fibre is facilitated by the application of grease.

Matting, as distinct from the several kinds of mats already referred to, is made on both hand and power looms of the usual type, the former being used principally for the narrower width and cheaper kinds. When we consider that cocoanut matting is made in 50-yard rolls, and as much as 72 inches in width, it is obvious, I think, that this could only be worked on a very powerful loom.

In construction this does not greatly differ from the ordinary loom employed to weave other fibrous materials, but as the fibre used is of such a heavy and bulky character, it is imperative that the machine should be very strongly built. I believe these looms are similar to those used in weaving jute, and they have very large projections at the end of the lathe for shuttle boxes to receive the great heavy shuttles employed. When contrasted with looms used in other branches of the textile industries they appear crude and roughly finished, but there is no doubt they are perfectly adapted for the work required of them. The matting is practically finished when it leaves the looms, but every yard of it is very carefully examined for imperfections. It is then put through a rolling or flatting machine and passed on into the warehouse. I should like to mention in passing that it will be found that the rooms used solely for weaving matting are, as a rule, clean and well kept, being a great contrast in this respect to those rooms in which loose fibre is used in the processes of manufacture. I have already referred tc the Finishing Room, and two of the machines used there, viz., the combing machine and the shearing machine; the former is used for removing loose fibre from mats, and consists of two rollers between which the mat is passed; the upper roller has projecting steel teeth which remove all loose ends and leaves the surface fairly even. The shearing machine is practically a cropping machine, similar to that used in jute mills and carpet factories. In construction it resembles nothing so much as a lawn mower; the lower roller, which carries the mat, presses it against the upper roller with knives set spirally around it, and the surface is shaved clean by these spiral knives.

It is desirable to state, before concluding this summary of the outstanding fire hazards, that all the processes except dyeing and bleaching are dry ones—that none of the machinery, except, perhaps, the teazing machine, runs at a high speed, and that the physical hazard rests rather in the nature of the material being manipulated than in the method of its manipulation.

Physical Hazard.

In this connection, first let me direct your attention to the Teazing House. There are, to my mind, two great dangers, from a Fire Insurance point of view, in the teazing of coir fibre. The first, which applies with equal force, of course, to the teazing of all textiles, is the possibility of foreign substances, metal or

grit, being carried into the machine with the material and sparking through contact with the steel teeth of the teazer. The second is that although, as I remarked before, the fibre itself is clean, the action of teazing necessarily breaks a certain portion of it into very short lengths, and these are highly inflammable. For these reasons the teazing should always be done in a building completely isolated from the other portions of the risk.

The Finishing Room must be regarded as one of the danger spots in a matting factory, consequent on the rapid accumulation of refuse fibre, and it is most necessary to insist upon absolute cleanliness in the neighbourhood of the combing and shearing machines, all refuse being removed as made.

In all parts of these factories in which loose fibre is used, it will generally be found that there is a great accumulation of refuse of a highly dangerous character. In some factories that I have seen there is a systematic attempt to deal with this state of things by employing boys whose sole duty it is to remove the refuse. This is never altogether satisfactory, as it is next to an impossibility to keep the looms, which are generally erected as close together as practicable, quite clean.

There is another point I should like to refer to here, and that is the method of lighting. In most factories the working hours are from 6 a.m. to 6 p.m., so for the greater part of the year no artificial light would be required, but in the winter months artificial light of some kind must occasionally be used, and for this purpose there is nothing so satisfactory as the incandescent electric light. Every loom must have its own light, and where gas is the illuminant the burners should be protected by wire globes, and these should be constantly dusted down.

Another point is, that in those rooms where loose fibre is used there should be a plentiful supply of buckets already filled with water, every loom having at least one.

In a factory I inspected in Suffolk, every weaver was made responsible for seeing that the bucket of water at the side of his loom was kept filled, and a fine of 1/- was imposed if this duty was neglected.

Loss Experience.

With regard to losses, these have been few in number but serious in amount.

A fire at Sudbury, in 1885, did damage amounting to several thousand pounds. I have not been able to get the exact figures.

In May, 1901, the back portion of another factory in the same town was totally destroyed, and £6400 was paid in satisfaction of the loss.

Quite recently a factory at Lavenham, only a few miles from Sudbury, has been almost entirely destroyed, resulting in a probable loss of £16,000.

The offices have therefore paid away a very large sum in respect of losses on these risks in a comparatively short period.

Bearing these facts in mind, it is not difficult to understand why the offices have never looked with favourable eyes on these risks.

Before I conclude I should like to offer my hearty thanks to Mr. G. Whittle, of Long Melford; Colonel Sly, of Lancaster; Messrs. Kolle & Sons, of London; Messrs. Helling & Co., of Hamburg; and Messrs. Shepherd & Sons, of Holme Mills, near Carnforth. These gentlemen have given me valuable information, and without their kind assistance many interesting facts regarding the coir fibre and matting industry would not have been obtainable.

THE VALUE OF FIRE-EXTINGUISHING APPLIANCES.

By WILLIAM HARTLEY, Esq.

A Paper read before the Insurance Institute of Manchester, April 11, 1905.

EXPERIENCE has taught many persons—and experience generally is a costly and bitter teacher—of the truth of the quotation that "A little fire is quickly trodden out, *which, being suffered, rivers cannot quench.*"

This concerns all—fire is an element which distinguishes not between the humble home of the cottager or the mansion of the millionaire. It is therefore a matter of prime importance that fires should be dealt with in their incipiency, and more attention is now being paid than hitherto to the desirability of dealing with outbreaks in their early stages, both by the owners of private concerns and municipal bodies.

The appliances to be found in private establishments range from the unassuming pail or bucket up to the elaborate automatic sprinkler installation, with, in some cases, steam fire pumps or portable steam fire engines, together with automatic fire alarms.

Public brigades in most of our principal cities and towns are now furnished with powerful steam and manual fire engines, in addition to the exceedingly useful chemical engines, hand pumps, hose, and all the other necessary adjuncts of well-equipped brigades; to these brigades are attached men who are devoted to their calling and fear not the loss of life or limb in the carrying out of their hazardous duties. Notwithstanding, however, the effectiveness of our modern fire-extinguishing appliances, there is much to do before we shall arrive at the time when, to use the words of Mr. James

Braidwood, "Instead of hearing of the dreadful losses by fire and the great exertions made to extinguish it, all the notice would be such a place took fire, the engines arrived, and it was extinguished."

These words were penned by Mr. Braidwood, who was at one time Firemaster of Edinburgh, in his book entitled "Fire Engines and the Training of Firemen," published in Edinburgh in 1830; and it is now three-quarters of a century since they were used, and we are not yet within sight of the goal so much to be desired.

As extinguishing appliances have improved and become more effective than in the old days, the difficulties of dealing with fires have enormously increased—buildings are now much larger and loftier than formerly—and the means and methods of dealing with outbreaks of fires at the present time demand, and must have, more attention than formerly.

"Fire-fighting," moreover, is becoming more and more of a science, and the more general adoption of *reliable* automatic fire alarms (which are at present in their infancy in this country) will, by giving an early alarm, doubtless do much in preventing those huge conflagrations which startle us from time to time. Very large fires cannot be extinguished; they simply burn themselves out; water thrown upon them is evaporated by the intense heat and tends to feed the flames; and it will be recognised, then, how important is the necessity of dealing with outbreaks at an early stage.

This has been fully appreciated by many private firms who have installed expensive equipments; this is all right as far as it goes, but there is another thing to be kept in mind—an all-important one—that is; that care and attention shall be continuously bestowed upon them, otherwise it may be found that when wanted they will not be in working order, with the result probably of the fire getting out of hand and a serious loss arising.

In every process of manufacture, in these days of keen competition, it is essential that the plant generally shall be looked after with the very greatest care and kept up to date, and unless this is done the chance of turning out an article which will readily sell and give satisfaction to the merchant and consumer, and at the same time leave a profit to the manufacturer, is very remote. But is this same care given in the case of appliances provided for the extinction of fire? We are sorry to be forced to admit that in many instances it is not so, probably because the owner does not ·k upon them as being active contributors to his profit. And

yet in how many cases have appliances which have been properly kept up been the means of quenching a fire in its early stages, and thus saved a large loss, not only to the Insurances Companies, but to the owner and occupier also? It must also be borne in mind that although Insurance Companies may recoup an individual or a firm for loss sustained by fire to property, they do not and cannot in a prosperous undertaking (notwithstanding the fact that insurances may be now effected against loss of profit) make good altogether the loss which arises by the severance of connection which frequently comes about after the occurrence of a disastrous fire. Customers, who in consequence of manufacturers not being able to supply goods to meet their wants, have in the meantime gone elsewhere, and having obtained satisfaction a connection once broken is difficult to regain.

A serious fire may possibly cost the firm its very existence, business may be diverted, the employés scattered, and by the time the premises are rebuilt and in working order the trade has gone elsewhere, never to be recovered.

How often have we heard the lament when visiting the scene of a disastrous fire, one of the hands exclaiming that "if we had only had a bucket of water we could have saved the place."

As showing the value of having fire buckets filled with water ready for emergencies, we find from a statement made by Mr. W. H. Hunter, the chief engineer of the Manchester Ship Canal Company, in a paper he read at the International Fire Prevention Congress, held in London in 1903, on the "Value of Fire Patrol Systems in Harbour Property," that:—

"For instance, in the year 1902 nineteen outbreaks of fire were discovered on the dock estate by the constables on patrol—every one of these outbreaks was promptly extinguished, in almost every case the extinction being effected by means of the water in the fire buckets which are provided for such contingencies. On several occasions, sometimes through real apprehension, more often through excessive zeal, alarm has been given to the fire brigades of the corporations, and these brigades proceeded at once to the docks, but fortunately on no single occasion has it been necessary to call upon them for active assistance, as in every case the outbreak had been caught in time and wholly extinguished by the men of the company's own brigade, the fire damage to the buildings on the estate having been nil, and that caused to the goods housed in them absolutely trifling."

If only the antidote were at hand, and the agency to apply it when first needed, there would be no more (to use an American phrase) "ash heaps." However, fires are like the poor, they are always with us, and the best that can be done to reduce the enormous "fire waste" which goes on year after year, is to endeavour to the best of our ability to educate our fellowmen as to use and value of extinguishing appliances, so that they will in their turn see that it is to the advantage of all to provide the necessary means of effectually dealing with our old enemy "the fire fiend," who is a cruel and insidious foe ever read to leap upon us—sleeping or waking—and destroy without compunction all that we possess or hold most dear.

Numerous cases have occurred where, after long periods of bad trade coupled with "short time," there had been a turn for the better—the employés' hopes were running high that there would be "full time" and plenty of work for all, when, alas, a fire breaks out, and what was a short time before a busy hive of industry is quickly converted into a heap of hissing and smoking ruins, entailing a serious loss to the owner and to the Insurance Companies concerned.

So far as the employés are concerned, what does it mean?

The chances are that in order to get employment new homes will have to be sought in some far-away towns, with the likelihood in any case of being out of work for some time, which, to married men with families, means privation not only to themselves but to their wives and children.

And all this would probably have been avoided if, when the outbreak occurred, there had been a few buckets of water or a chemical fire extincteur close at hand.

Owners and occupiers of premises, especially those where a large number of hands are employed, have duties which they have no right to disregard. One duty is that of providing safeguards against the ravages of fire, and which they owe both to themselves and to the community at large.

Portable chemical fire extincteurs are a most useful fire-extinguishing appliance. As you are all aware, the liquid contained therein, when ready for discharging, is generally composed of soda and sulphuric acid, capable of throwing a jet at a good pressure for a considerable distance, which will, immediately on contact, extinguish a fire in its early stages. They can be used to great ıntage in positions where water from buckets is not easily thrown,

and for fires in their incipiency in which turpentine or other spirit and oil is involved they are of the very greatest value. A case recently occurred in which a quantity of sawdust on the floor, impregnated with oil and turpentine, took fire, and a man's life was sacrificed, and two others severely burnt, while they were endeavouring to remove a barrel of turpentine which was near the flames, and which exploded whilst this was being done. We have no hesitation in saying that if a chemical fire extincteur had been at hand the fire would have been easily extinguished without our having to record loss of life.

In some cases appliances are put down simply in order to obtain the discount from the Insurance Companies, and once put down, would never be looked at, unless the owner's memory was occasionally jogged by a zealous surveyor, that such a thing as a discount had been allowed for same. Buckets empty, or not to be found when wanted—an alarm of fire is raised, willing hands rush for the buckets, find them empty, then for the hose; but as they have not had the necessary practice to handle it with ease and celerity, everything is in a state of confusion; in the meantime the fire is making rapid headway, and by the time the hose is coupled up and water turned on it is beyond control, and the building and its contents are doomed.

There are, however, bright sides to the picture. We find firms who spare neither time nor money to have their fire-extinguishing equipments up to date, who see for themselves that everything is ready for instant use, and the members of their brigades (who are drawn from their own employés) are carefully drilled month by month, with an occasional alarm of fire thrown in for the purpose of enabling them to learn to keep cool and not lose their heads, so that when the hour of real necessity arises each man is in his properly appointed place and knows exactly what to do.

Do such employers go to all this trouble and expense for the purpose of obtaining a discount from the Insurance Company? The answer is distinctly in the negative. These firms *know and fully appreciate* the value of fire appliances and their use *in the early stages of a fire*, and they are simply adopting the same methods as they apply to other portions of their business, and are not going to leave anything to chance. If they have millwrights or engineers working after a breakdown of engine, shafting, or machinery—these events happen to all people more or less, do what they will—and as repairs of this nature are chiefly done during the night time,

Saturday afternoons, Sundays, and other holidays, when the regular staff of employés is away, and by men who are not directly in the employ of the owner or occupier of the premises, they will leave a responsible and trustworthy employé in charge, and have their chemical extincteurs ready, or their hose coupled up to where the men are working, so that in the event of an outbreak of fire all is in readiness for instant use.

Every second of time in an outbreak of this kind is of immense value, inasmuch, on account of the quantity of grease about gearing or machinery, that, if the fire only obtains a fair start, the mill is almost certain to be destroyed.

How many disastrous fires might have been averted if only the simple precautions above referred to had been adopted?

Many of us here this evening are painfully aware of the losses our respective Companies have suffered from careless millwrights, and which might have been entirely averted, or greatly mitigated, if only the very simple, but needful, precaution of having either hose or chemical fire extincteurs *ready at hand.* But no, some people must have a baptism of fire before the necessity of providing for emergencies of this nature is brought home to them. A fire breaks out, and although the workmen about know where the appliances are kept, all is in a state of excitement and confusion, precious moments are lost; the fire in the meantime is obtaining a firm hold, and by the time the hose is coupled up and water turned on there is not much hope of saving the premises from destruction.

As illustrating the great danger arising from the employés' want of knowledge in handling appliances, we recall a case which came under our notice a few years ago. In this instance the owners had supplied appliances which were as good as they could reasonably be expected to be, but fire appliances, however perfect, are absolutely useless unless there are persons about who know how to use them in case of emergency. Hose and hydrants had been fixed on each landing of the staircase, the water supply being from the town's main and also from a steam fire pump. A fire breaking out, the employés in their want of knowledge and haste to connect the hose to the hydrant, by some means did not get it properly attached, with the result that when the water was turned on the couplings parted, allowing the water to simply flow on the floor, and before matters could be adjusted the flames had got firm hold of the room, driving the men away and the premises were eventually burned to the ground.

In this case not only was there a great destruction of property, amounting to something like £60,000, but there were some nine or ten lives lost, and the probabilities are that if there had been a proper system of drill, the premises with their contents, together with valuable lives, would have been saved. Every praise is to be given to the poor fellows who so heroically did their utmost to save their employers' property, and whilst we have such staunch material with us surely it is as little as employers can do to give them the opportunities of making themselves familiar with the use of appliances provided. The men might have left the mill and escaped practically uninjured, but they sacrificed their lives in the interest of their employers and in performing what they considered to be their duty. What an awful lesson learnéd in sorrow and suffering—bread-winners suddenly taken away, never to return. Let us fervently hope that such lessons will not be lost upon the community, and that they will not go unheeded.

The value of extinguishing appliances is very forcibly brought to our notice when a manufacturing risk (especially if it be a cotton spinning mill or some other equally hazardous risk) is offered for insurance in some isolated country district, the risk not being protected by a reasonable outfit of fire-extinction appliances. We look upon it very shyly; if accepted, as it may be for the sake of a connection, we take care not to accept a larger sum than we can avoid, and then probably reinsure as much as possible.

It is pitiable to see the frequent accounts in the newspapers of the large amount of waste caused by the ravages of fire in country mansions, and it seems to us that many owners will not go to the trouble and expense of providing the necessary appliances for speedily and effectively dealing with fires in their incipient stage, apparently waiting for the experience of a disaster before the fact of the value of fire-extinguishing appliances is fully brought home to them.

These risks are nearly all situated far away from any effective outside assistance, and therefore it is highly desirable that they should be equipped with such fire-extinguishing appliances as can be adapted to meet the exigencies of each particular case. For large mansions a proper system of water supply should be laid down wherever possible, and a manual or steam fire-engine provided with the necessary hose and other appliances, together with men trained to their use.

One or more large water tanks on the roof with connections to hydrants and hose on the staircases would be of great value.

Then, again, chemical fire extinguishers, hand grenades, and hand pumps are invaluable for checking incipient fires, and particularly so in remote spots where there are no ready means of communicating with a fire brigade, which may be some five or ten miles away. By the time the brigade arrives it is generally found that it is impossible to save the premises. A messenger has had to be sent on horseback, which takes up a considerable time; or the butler (as in a recent case), although only clad in his night attire and slippers, had to run to the village and alarm the brigade. This all takes time, and the fire in the meanwhile is burning merrily, instead of which, had a little foresight been exercised and the necessary expenditure incurred, water would have been poured upon the flames and the fire held in check if not extinguished by the time outside assistance had arrived.

The value of having appliances at hand is shown in the case of a fire which broke out at a well-known and historical castle, situated far away from any effective outside assistance, but in this instance, owing to the fact that the castle had been destroyed by fire some years before, with all its valuable contents, special provision had been made for coping with any other fire that might arise, and it was therefore in all probability due to this circumstance that the second fire was soon extinguished. Had it got out of hand it would have become necessary to flood the castle from the great water tanks on the roof, which had been constructed especially for use in the event of a fire gaining a firm hold.

It will be seen in this instance that water supplies had been a source of difficulty, but this had been surmounted by the construction of the water tanks on the roof.

Here the owner had fortunately profited by experience and gained thereby:—

"One thorn of experience is worth a whole wilderness of warning."

Had owners of mansions but the foresight to provide an adequate system of fire-extinguishing appliances, there is no doubt but that property worth millions of pounds would have been saved, and priceless works of art would have been still in existence, and which cannot now be replaced. This is a loss to the nation at large as well as to the actual owners.

Lack of means financially certainly cannot, in the majority of cases, be the excuse for not providing adequate fire-extinguishing

appliances, and it is to be hoped that owners of mansions will become more alive to the fact, that if they are to keep their valued treasures reasonably safe from destruction by fire, they will have to take steps to provide sufficient appliances for mastering the foe which is ever ready to attack and destroy.

The provision of fire-extinguishing appliances and water supplies by municipal and urban authorities generally, is one of the greatest interest and importance to Insurance Companies, from the point of view of rating, the acceptance of business, and retentions. We have seen in our own country what devastation can be caused, and how a fire will spread, if there are not adequate fire-extinguishing appliances to deal with it in its early stages. We well remember the case of Ilfracombe, where a fire commenced in a shop and spread across several streets, altogether consuming quite a number of shop premises. The fire brigade here appeared to be overpowered by the celerity with which the flames leaped from building to building, and added to this was the fact that it was some time before an effective water supply could be obtained; and it must be kept in mind in this case that it was not a question of large and lofty warehouses crammed together, as was the case in the outbreaks at St. Mary Axe and Cripplegate, London, but an ordinary seaside town, where such a thing as a "conflagration" would scarcely be looked for. True, the damage in the aggregate was nothing of very serious importance, and the case is only cited as showing the necessity of having adequate appliances with water supply even in these small seaside towns.

In this particular case a good number of Offices lost a much heavier sum than they expected to do, on account of the fire spreading over a much larger area than ever was anticipated.

Automatic sprinklers, which have been very aptly described as "a fire brigade by night and by day," and drenchers are the ideal protectors against the spread of fire; and in connection with the conflagration at Baltimore, there is little doubt that if the building in which the fire originated had been protected by an approved installation of automatic sprinklers or drenchers, the flames would have been confined to this building, whereas the fire was not subdued until it had devastated about 80 city blocks, destroying some 2500 buildings.

It is scarcely possible to conceive what distress and privation is caused by such terrible conflagrations beyond the loss of property. Employés are thrown out of work for many months, and their

wives and families suffer both from the lack of shelter and food, and it is therefore incumbent upon municipal authorities—and should be made *obligatory* by the law of the land—that efficient appliances and water supplies are provided in all cases.

In the Baltimore case the Insurance Companies would have saved some £14,000,000 sterling if the fire could have been confined to the building in which it started, and it behoves us then, as we well know the value of appliances, to do our utmost to try and get the most perfect and effective systems adopted everywhere.

Let us take the conflagration at Toronto, which occurred on the 19th April, 1904—the fire spread over an area of nearly 20 acres, but this included five acres of street allowances, leaving the total block area of conflagration equal to 15 acres, and in all there were about 100 separate buildings destroyed, doing damage to the extent of about £2,500,000 sterling. We find here that the fire originated in a building of four storeys in height. When the firemen arrived it was found to be impossible to enter the premises, and the fire was extending across a narrow lane into the adjacent premises. Had the building in which the fire originated been protected with sprinklers, the probabilities are that it would have been standing to-day, and the Insurance Companies saved a heavy loss.

This, then, is another object lesson which should be taken to heart, and we should profit by the experience so dearly gained. The balance-sheets of our Companies doing American and Canadian business for the past year will all bear the impress of the disastrous losses of Baltimore and Toronto.

Why do we not impart a little more vigour and earnestness in urging property owners to take advantage of such effective appliances as sprinklers and drenchers?

We who are day by day, week by week, month after month, year after year brought face to face with the value of extinguishing appliances ought to do our best to reduce the lamentable "fire waste" which is going on continuously. Are all these object lessons to be thrown away?

Would it not conduce to the peace of mind of all the managers of our great Fire Insurance Companies if such a thing as the "conflagration risk" could be eliminated?

"Conflagration" hazard depends, of course, upon the degree of "exposure" hazard existing, and it should be our object to encourage any appliance which will effectually reduce this risk.

Insurance Companies in the United States and elsewhere have

before now been wiped out of existence by reason of excessive losses sustained through conflagrations, and it is therefore to our interest to take such means to safeguard the funds of our respective Companies being unduly depleted by excessive losses, as may lie within our power.

We stand aghast when we think of the immense amount of damage which could be done by a fire if it thoroughly got out of control in the business portions of the city of London. No doubt we are served by efficient officers and men, and are well supplied with steamers and other appliances common to fire brigades, but if there were a system of drenchers installed over windows and roofs of all buildings in the more congested areas, these would doubtless be of inestimable value. Probably we shall be met by the statement that the pressure of water would not be sufficient to reach the drenchers in the higher buildings. To this we would reply—"Why not make such arrangements for one or more steam fire engines to couple up with the pipes supplying the drenchers, and thus keep up a good and effective supply of water even at the topmost drencher?"

This could be done, and are not fire brigades and sprinklers primarily for the same object, viz., that of extinguishing fires?

Why, therefore, should not the fire brigades recognise, and in every way appreciate and encourage, the use of sprinklers and drenchers?

We cannot lay too much stress on the importance of dealing with a fire in its incipiency. A bucket of water in many cases is sufficient if there is only the agency to apply it. It is said that the fire at Baltimore was only one of small dimensions in the cellar when the fire brigade arrived, but by some means or other it got beyond control, and had there been a single sprinkler there it would have been extinguished without outside assistance, and all our companies would have been saved a serious loss.

What does the "Finance Chronicle," London, say about automatic sprinklers? Listen:—"Slowly but surely the automatic sprinkler assisted by automatic alarms is contributing more to the solution of problems connected with successful fire-fighting than any other agency."

Drenchers or outside sprinklers are invaluable in preventing fires spreading, and in the Baltimore conflagration they were the means of saving more than one building.

Sprinklers have saved innumerable buildings with their contents

from destruction by fire. Hear what Mr. E. U. Crosby, of the North British and Mercantile Insurance Company, and secretary of the National Fire Protection Association, said in a very interesting address delivered some four years ago before the New England Water Works Association about the value of sprinklers.

After referring to "fireproof" buildings, so-called, and finding that even the best types are not "fireproof" so long as they contain combustible contents or are exposed by combustible buildings and inflammable stocks, he then goes on to say:—"Furthermore, it would be impracticable within our day and generation to tear down a city and replace it with these so-called 'fireproof' structures. Neither can we do away with their 'combustible contents,' *so we would be quite at a loss were it not for another factor, which is on the increase every year, namely, 'the automatic sprinkler system.'*

"This type of protection has been developed during the past twenty years. It was first applied to mills and workshops, and almost all such properties of prominence are now so protected. These are mostly isolated risks and alone receive the benefits of such protection, but when a system is installed in a city every property in the conflagration district profits.

"It is not my intention here to advocate the automatic protection of individual city risks, which is already a well-established custom, but to point out the great saving of fire cost, the feasibility and the practicability of the automatic sprinkler protection of *all* buildings in the congested districts of cities, in other words, the practical elimination of the conflagration hazard. It is possible that underwriters may be able to hasten this work by allowing a special rate reduction upon a block when all the buildings therein are sprinkled.

"Automatic sprinklers afford the chief means of private fire protection, and possess a prompt penetrating power not obtainable by any other known means.

"They are *instantly* long before any alarm could be given at the public fire box: *locally* at the seat of fire, not being blinded by smoke into discharging large quantities of water where it is not needed, and *forcibly* when properly installed and fed by water under heavy pressure, filling the place with an irresistible deluge, which not only quells the fire, but blankets the smoke which would otherwise drift through the building, accomplishing an uncertain damage, impeding the exit of the inmates and the subsequent duties of watchmen and firemen.

"This cannot be done by hose-stream service, and it is time the fact was realised.

"Already property owners in large numbers have installed sprinklers: their buildings are dotted here and there all over the city maps. What is needed now is the filling-in of the intermediate spaces. Shortly the community will call for it. If three-fourths of the buildings in a block are equipped, the portion not protected will be considered as a public menace, and public statutes may properly compel its equipment."

Again :—"Insurance Engineering," under the head of "Automatic Sprinklers" in its January issue of last year, says :—

"Everett U. Crosby observes that the ideal means of extinguishing a fire is evident to the minds of all competent fire-protection engineers. They desire three things :—

"(1) A prompt application of water, prompt almost to the extent of being instantaneous with the fire outbreak.

"(2) The discharge of the water locally, precisely at the seat of fire, and distributed so that the least amount of water will do the largest amount of good.

"(3) An immediate notification that a fire is in progress.

"These conditions are all fulfilled by the approved automatic sprinkler system, thus showing that the ideal is not only possible but practicable; an undisputed ability to meet these specifications is well proven; this type of protection is destined within a short time to be generally regarded as the apparatus-in-chief for the extinguishment of fires."

After hearing such strong commendation of the efficacy of sprinklers, and coming from a gentleman of the standing and experience of Mr. Crosby, there can surely be no halting between two opinions as to whether we should or should not do all in our power to get installations fixed internally in all large risks; and in congested areas in our large towns to have all blocks protected by outside sprinklers or drenchers. We can readily imagine what an effective water curtain would do in preventing an extension of fire in the crowded areas of the business portions which exist in all large cities, and were such a system of sprinklers and drenchers generally adopted we might reasonably look forward to the time when the conflagration hazard would all but disappear. There would be a tendency for such conflagrations at home as those of Cripplegate and St. Mary Axe becoming things of the past, to the ultimate benefit of all.

We have also further testimony as to the good work done by sprinklers. This is given by Mr. Edward Atkinson, who is an eminent authority on such matters, in a report which he made to the Boston Manufacturers Mutual Insurance Company. Mr. Atkinson states :—

"Considerable doubt existed at one time in respect to the security which sprinklers would give over cotton, wool, or paper stock piled high. That doubt has been removed by the successful operation of sprinklers in warehouses insured by us, and also in large cotton storehouses, which have been protected in the south. *There is to-day no question as to the adequacy of sprinkler service for the protection of storehouses.*"

These eloquent words speak volumes in favour of the adoption of sprinklers, and when we have men of the standing, ability, and experience of Mr. Crosby and Mr. Atkinson speaking out so unhesitatingly and so strongly, nothing can prevent the spread of sprinkler protection, and we shall, doubtless, in time see them more and more installed in our large business premises both at home and abroad, and it behoves us then to use the knowledge we possess as to the value of automatic sprinkler protection to do our utmost to encourage the fitting-up of installations of these valuable appliances, especially in the congested areas of the business portions of all large cities.

The City of Boston (U.S.A.) has apparently taken to heart the lesson of its own great fire in 1872, whereby about £14,000,000 worth of property was consumed or otherwise rendered worthless, and also by subsequent conflagrations elsewhere, as we find that there are no less than 110 sprinkler installations in the warehouse area of that city, and which have given uniform satisfaction wherever they have been called upon to operate. The water supplies are said to be good, there being two services, viz. :—high and low pressure. It is necessary, as we all know, that good pressures and flow of water are absolutely necessary to cause sprinklers to do their work properly.

Coming nearer home we find a case of a large premises in Glasgow protected internally by sprinklers and externally by roof and window drenchers, which were by the provision of these appliances undoubtedly saved from destruction by fire which broke out in a large warehouse on the opposite side of the street, and extended · warehouse on the opposite side of a narrow lane, doing he extent of £100,000.

The premises protected by sprinklers and drenchers were well within the risk of the fire, and we herewith append an extract from a Glasgow newspaper pointing out the value of drenchers. This extract reads:—"One result of the conflagration will be to impress upon the public the value of such preventive measures as the permanent roof-drenchers, which were brought into operation on some of the adjoining buildings. In a closely-built city the value of such appliances for the control and isolation of an outbreak of fire cannot be exaggerated."

A great deal more might be said about the efficacy of sprinklers. They are, unlike most other appliances, ready at a moment's notice to automatically discharge water on the seat of the fire which breaks out when least expected, and their record up to the present has been very satisfactory.

Automatic fire alarms fixed inside buildings are now coming more to the front in this country than has hitherto been the case.

They are being energetically pushed by their respective representatives, and if they are found by experience to be as reliable as the makers claim for them, they will be valuable adjuncts in preventing the spread of fire.

An early alarm is of vital importance, and it would seem something of this kind is wanted, particularly in congested areas, so as to enable fire brigades to be in early attendance.

We find a speaker stated at the International Fire Prevention Congress, that

"Statistics show that although the cost per head of population of our Fire Brigade in London is about double that in Dublin, Manchester, Liverpool, or Glasgow, *still the fire loss per head of population is also about double instead of, as we might easily be led to hope, one-half.* I think everyone will admit without the least hesitation that the fault cannot be with our men. There can only be one opinion on the question—our firemen are as brave and as self-sacrificing as any other firemen in the world, and their devotion to duty is second to none. Therefore, the reason is not to be found in this direction. I venture to think that it is to be sought for in the direction *of the quickness and speed with which extinguishing apparatus can be brought to bear after a fire has been discovered.* Mr. Lepine in his remarks at the opening of the Congress gave a French quotation respecting the value of water at the commencement of a fire which is extremely apt. He said in the first second you require a glass

of water, in the second second a pail of water, and in the third second a barrel of water, and emphasised the remarks of the Congress from the point of view of attacking an incipient fire at the glass-of-water stage."

An appliance, and a very effective one, for use in cases where a fire has got a firm hold in the upper storeys of large and lofty buildings is the "Water Tower," but so far as we know it has not been adopted in this country, though the same object has to a limited extent been achieved by lashing a hose to a fire escape and taking it up to the level of the storey on fire. The "Water Tower" is in use in New York and other cities in the United States of America, and is said to be the greatest friend and the greatest enemy the Insurance Companies ever had, for while it is very effectual in quenching a large fire quickly, yet it does enormous damage by the large quantity of water it is able to throw on the flames on any floor. The nozzle is fixed so that it can be moved in any direction, thus ensuring that the water goes straight in through to where the fire may be raging. As we all know, at times a large quantity of water from jets which are worked from the ground level never gets inside the building at all.

The effect of the use of the "Water Tower" is that, whilst it practically drowns out the fire, the amount of damage which is caused to perishable goods in the lower floors is very great. However, whatever damage may be done by water, be the stock as perishable as it may, it is a great thing when once a fire has got firm hold to prevent the structure itself being utterly destroyed and preventing the flames extending to adjoining risks.

We are sorry that the law does not in this country *compel* municipal and urban authorities to provide adequate protection in the way of the provision and maintenance of adequate fire-extinguishing appliances. These authorities have the power if they wish to exercise it, but they are in a good many instances too parsimonious to spend money in this direction. Only recently a case came under our notice where the Fire Brigade was handicapped by out-of-date appliances, and had it not been for the prompt response of a brigade 10 miles away (which was luckily in the hands of a more enlightened and broad-minded authority) who brought their steamer and subdued a fire which threatened to extend and do untold damage. For several years there had been an agitation for better protection against fire, and the Urban Council had the matter before them, but nothing had been done.

We hope, however, the lesson of the want of appliances will be one that they will take advantage of, and at once take the needful steps to put their brigade upon such a footing as will enable it to deal satisfactorily with any fires that may break out in the future. Another case, and also a recent one, we find it stated in connection with a fire which broke out in the sixth storey of a seven-storey mill, that the "Urban authority had ordered a steam fire engine six months ago but it has not yet been delivered. Delivery had not been pressed because there was no engine-house to store it. The foundation-stone of a new fire-engine house was laid only a month ago. It is now thought the new engine will be asked for forthwith and given a temporary habitation, so that there may be no fear of another mill being destroyed without an adequate attempt being made to save it."

These are not the only instances where ignorance or apathy or both exist, as we find from a Report which was made by a Select Committee which Parliament granted in 1899 to inquire into the question of "existing arrangements for the provision of fire brigades, &c.," that

"The Committee consider that the inadequate provision against fire shown to exist so largely throughout the country is due sometimes to ignorance or doubt (caused by defective legislation) on the part of such authorities as to the powers they actually possess."

It is to be hoped that for the sake both of life and property something will be done by Parliament to compel all public bodies to provide a reasonable supply of up-to-date appliances for the suppression of fires, and having provided them, hold them responsible for their being kept in proper working order with a sufficient staff of trained men to work them. This is a national question; insurance companies may recoup and indemnify sufferers for any monetary loss they may sustain, but all the same anything that is consumed by fire is a loss to the country, and the sooner this is realised by the "powers that be" so much the better.

If only a fraction of the waste caused by fire could be saved by the adoption of modern fire-extinguishing appliances, it would well repay the outlay.

The world's annual bill for fire damage must amount to a stupendous figure—too great almost for us to realise what it means—and it becomes then the duty of all to do what they can, individually and collectively, to help forward any movement that can add

to the sum of the world's wealth. Our old friend "The Policy Holder" once remarked:—

"Property destroyed is a loss to the world just as much when insured as when it has no such protection, although we often speak as if insurance made good any loss as far as it went and the only waste was the excess beyond insurance."

With these remarks we entirely agree, and the thanks of the community are due to those men who are devoting their time and energies to the invention of new appliances, and to the improvement of those already in use, which will help to subjugate that most cruel and relentless enemy of mankind when it gets out of hand—Fire.

Our firemen, too, who fight so stubbornly and persistently in order to subdue the foe, must not be forgotten; their duties involve fatigue, danger, struggle, and frequently death; truly, their deeds are those of valour.

A few words more before we close. Let us remember that "water afar won't quench a fire at hand," and though the best of appliances may have been obtained, they are useless unless a plentiful supply of water at a good pressure is provided, and to this end the attention of all, and especially public bodies, should be called.

BACON-CURING FACTORIES.

By JAMES R. WARNER.

A Paper read before the Insurance Institute of Ireland, March 31, 1905.

THE Bacon-curing trade has been so developed in Ireland that it now forms one of the important industries of the country.

Mr. A. W. Shaw of Limerick, writing on this subject in 1902, quoted the following from a statistical review of the Irish bacon and provision trade given in 1860 by the then Solicitor-General for Ireland:—

"During the Peninsular War Ireland possessed a great trade in curing beef and pork. Cork, Waterford, Limerick, and Dublin, all afforded their quota of beef to the English Navy. Upon the proclamation of peace this trade fell off greatly, and the introduction of steam navigation, in 1825, tended still further to diminish the trade, for thus a ready market was opened up in England for the live animal; again, the repeal of the laws prohibiting the import of foreign cattle and provisions still further affected this trade, or so much of it as was left, and thus the supply of beef has passed into foreign hands. Live animals and bacon now form the staple article of the Irish provision trade.

"A large proportion of the bacon and hams cured in Belfast is exported to the Colonies, and the remainder finds consumption in this country, as well as in Lancashire and the North of England. A similar trade to that of Belfast has been carried on in Limerick for many years. In the North the pigs are killed by the farmers at their own homesteads, and then brought to market; while in Limerick they are slaughtered in the curing establishments. In both cases the bristles are removed by scalding, previous to curing, while those animals intended for bacon for London must have the bristles taken off by singeing. Slight as this difference may appear, bacon prepared in the former way will not sell in the

London market. Belfast bacon and hams are shipped in a finished condition, dried and smoked, while those from the South of Ireland, with the exception of a portion manufactured in Limerick, are shipped in an undried state, and are dried and smoked at the other side."

There are in Ireland, not counting a number of small curers who kill merely to supply a limited local trade, some twenty factories, owned privately or by companies. These twenty factories deal annually with nearly a million pigs.

The largest curing centre in Ireland is Limerick, then Cork and Waterford, next in order, Belfast, Londonderry, Dublin, Tralee, Enniscorthy, Dundalk, Ballymena, and New Ross.

The process of manufacture of the bacon in a fully-equipped Limerick factory is as follows:—

Killing. The pigs are driven from the styes to the killing room, and there each animal is quickly suspended by a hind leg from a sliding bar and despatched, and the blood collects into receptacles under the floor.

Scalding. After hanging for a few moments the body is plunged into a vat, ready to hand, of scalding water heated by steam, in order to soften the bristles, which are at once scraped off.

Singeing. The whole carcase is then passed into the singeing apparatus in order to receive the first "browning." To suit some markets, including that of London, for instance, the bristles must be removed by singeing, which process, in that case, immediately follows the killing; for other markets, the scalding only must be done.

After these operations, the carcase is passed along sliding bars to be washed, scraped, cleaned, weighed, and branded, and it is then left suspended in the hanging loft for a period of from 12 to 24 hours, in order to reduce it to atmospheric temperature; after that, the carcase is cut up for the chilling rooms, the pickling, drying, smoking, and other processes, and for the treatment of the offal for a variety of purposes.

We shall now, in detail, consider the principal processes.

Singeing.

The first in importance is that of singeing. In olden times a quantity of lighted straw or reed was placed around the carcase in order to burn off the hair.

The forms of singeing apparatus mostly in use at the present time are:—

(1) A brick-built coal-heated furnace of sufficient dimensions to receive the entire carcase which slides along an iron bar and into an opening having a slender iron door in two hinged leaves which are closed on the entry of the body on which the flames play for a period of 12 to 15 seconds.

It is desirable that this furnace be contained in a separate compartment on the ground level, or on a fireproof floor if upstairs; the compartment in each case to be lofty, and provided with deep-sunken ashpits.

(2) A brick-built square shaft raised to a height of about 7 feet above the ground floor, and supported by iron beams on iron columns. On the iron platform level, 7 feet above the floor, is a small iron door of about 12 inches square in each side of the shaft, and used for the purpose of feeding the coal fire which is contained in a circular iron cage inside the shaft, the base of which is formed of a heavy iron disc. The carcase remains suspended by a chain for about 20 seconds in the centre of the fire.

I have seen these two singeing methods in operation, and, from a fire point, prefer the older form (1), because the falling and scattering about of live coal on the floor, although a flagged or concrete one, and an iron bar or two of the base of the fire during the hoisting and lowering of the carcase, and at a time when all hands are hard at work, is an element of risk which is absent in the first case.

About five years ago a firm of curers in the South of Ireland adopted an American patent apparatus. consisting of a brick-lined funnel into which petroleum, mixed with steam, was blown and ignited, and into the funnel the carcase was hoisted. This furnace did not give satisfaction, and was subsequently converted into a coal furnace with perforated fire-brick lining and fired from a fire-proof raised platform.

Gas-singeing is sometimes done, the apparatus consisting of a heavy iron concave block with perforations for the gas which plays on the carcase.

Branding.

Formerly this was done by means of solid irons heated in a large stove or hot-hearth; but this method has, except in a few factories, been superseded by that of irons heated by gas and air mixed; in

some instances, metallic, in others wire-covered, and elsewhere ordinary rubber, tubing is used. In one factory where the branding is done in the cleaning, washing, and hanging shed, the action of the water and brine on the metallic tubing was such that after a month's trial its substitution by wire-covered tubing had to be made. In other concerns the metallic tubing is used with satisfactory results in comparatively dry rooms. I mention these details as the comparative safety of the metallic or other properly-protected gas tubing is recognised by the Fire Offices.

Chilling and Cold Storage Rooms.

The absence long ago of adequate means of artificially producing a low temperature greatly handicapped the curers on economical and other grounds, both, in regard to the meat for consumption at home, and the export trade to England, so that the working operations had to be almost suspended between May and October. Several modes of curing bacon in the summer months were tried with varying results, until in about 1860 a Waterford curing establishment discovered a method of applying ice in the process, and this became wonderfully successful. According to Mr. Shaw, "this system was carried on in a very crude way at first, the ice being simply left in open crates in the centre of the building where the curing was in progress, in order to keep the air cool. The next step was the Harris Patent Ice House, which consisted of large chambers on iron floors supported by heavy beams or uprights; the necessity for strong supports will be understood when we mention that one of these floors had to bear as much as 1,000 tons of ice at a time. The bacon was piled in cellars underneath these chambers, the cold air from the ice overhead descending through the iron floors."

Later, in 1887, the South of Ireland curing establishments expended over £100,000 in the adoption of the modern ammonia, and carbonic acid, refrigerating plants of the compression and absorption types. For the chilling rooms an extremely cold atmosphere is not required, as it would be injurious to the juices of the meat, therefore a temperature varying from 36° F. to 42° F. suffices during the summer months. These cold rooms are almost entirely on the ground level, and have flagged or concrete floors which are always in a more or less wet state; in some, the temperature is kept low by cold air driven by fans through wood or iron ducts; in others, by the brine pipes which pass under the

ceilings. Some rooms for dry-curing, or storage of preserved foods, are insolated by means of sawdust, charcoal, or silicate cotton, which last material, from a fire risk point of view, is the safest of the three.

With regard to the ammonia refrigerating plants, which are those almost wholly employed in the Irish establishments, the following paragraph is of importance :—

The application of a moderate heat can make liquified ammonia dangerous, because the pressure thereby rises from 4·4 atmospheres at 32° F. to 10 atmospheres—83° F. The steel cylinders should therefore be kept cool and free from exposure to the sun. Ammonia gas in itself is a good fire-extinguisher, but with oxygen it forms explosive mixtures.

Explosion 12/4/04 Belfast Cold Storage Works.

During the winter months it is usual to open up the various parts of the plant at these works for examination and repairs where necessary. The socket which is screwed into the shell of the generator for the thermometer had not been securely fixed, and was forced out, allowing the gases to escape into the atmosphere, the pressure at the time being 90lbs. to the square inch. There seems to have been a combustible gas present in the generator, which it was thought had lodged there during the winter months, as it became ignited from a gas-jet in the immediate vicinity, when the generator had been nearly emptied of its contents, causing a slight explosion, but beyond the blistering by the flame of the lagging, no damage was done.

Fire 30/9/04 Cudahy Packing Co., New York.

The "Post Magazine" refers to a loss of about £60,000 caused by fire. Great difficulty was placed in the way of the firemen by the bursting of the ammonia pipes and tanks, and the ignition of soft coal, which emitted choking gases. Some 50 members of the brigade are said to have been overcome by the ammonia fumes.

I have mentioned this latter casualty to show that, *under certain circumstances*, the freeing of a large body of ammonia during progress of a fire may prove to be a disadvantage rather than an advantage to the Fire Office.

As ammonia is a gas lighter than air, ventilation at the roof of the refrigerating-plant house should be provided.

Mr. F. C. Moore mentions the "destruction (16th November 1902) of the large Armour packing plant at Sioux City Io-

of reports of tremendous explosions, which shattered buildings, due, probably, to gas explosions, although the explosions of the ammonia supply tanks are mentioned specifically as causing serious damage, and enforcing the importance of having such supply tanks safely located."

Consequential Loss. We must not overlook the question of consequential loss which the Insurance Companies may suffer from the increase of temperature consequent upon the destruction, in whole or in part, of the refrigerating machinery, through a fire arising from any cause in the plant-house, and thereby necessitating the removal—and a very quick one if in the hot months—of the meat to other cold stores, whether near or far.

Pickling.

A strong solution of salt, saltpetre, and sugar, or of any two of these, is injected by a needle into certain parts of the meat. The process needs no further comment.

Drying and Smoking Rooms.

It is necessary to dry the hams and middles and to bring about a "sweating" before smoking, otherwise the smoke would not penetrate the meat, but the temperature required varies from 70° F. to 75° F.; a higher degree than the last would spoil the meat, and the curer would also suffer by the loss of weight.

In some establishments a "green" trade is carried on, that is to say, the bacon (the whole side of the pig) is sent to the markets without having undergone an artificial drying or smoking process. This method of trading largely prevails in the South of Ireland—Limerick excepted—for the export trade, the meat being dried and smoked in England, &c., one reason being that home-smoked bacon would deteriorate in appearance through the usage it would receive in transit.

In Ulster, after the meat has been hanging for three or four days for natural air-drying, it is brought into the drying rooms, of which some have flagged, and others wood, floors; and some have the ceilings and walls matchboard-lined.

Steam or Low-pressure Hot-water Pipes. The prevailing method of artificial drying in Ulster is by steam or low-pressure hot-water pipes which are laid on the floors, or passed along the sides of the rooms; and occasionally, air-heated by steam coils, is propelled by means of fans along wood

ducts. Stoves with upright iron flues passing through the floors and roof, and open cressets, are also used. The meat remains suspended from wood or iron beams for periods of from one to four days, according to the methods adopted in the particular establishment.

Drying by steam pipes is also done in Dublin.

The systems of drying by steam or low-pressure hot water necessitate the banking of the boiler fires at night.

With these two methods of drying, the usual precautions concerning the contact of the pipes with woodwork, straw, or other inflammable materials, must of course be observed.

Ordinary Drying System.

With the exceptions named, the drying is done in special rooms of small superficial area, with incombustible ground floor, and walls of plain brick or cement, and slate or iron roofs with skylights—glazed or wooden—or wood louvres. The rooms are, as a rule, about 30 feet high. In some factories a single iron door is provided, in others iron-sheeted (on the inside), and ordinary, doors are used. Drying is done by means of coke placed in an open cresset, with or without an attachment to cresset top, by stays 18 to 24 inches long, of a cone-shaped guard. This guard is a simple and good protection, for the meat should it fall upon it, is thrown out of range of damage from the fire. In some instances a perforated iron floor, in others a strong wire-netting, is provided to catch the falling meat.

In these rooms from two to five tiers of wood beams are provided from which the meat is suspended by hooks, remaining there for about four days, and, as these fires must be maintained during the period, they are looked after at night by the watchman.

For the drying room just described, a tight-fitting iron, or iron-covered, door is desirable, both on the ground level and to each required opening above, also a tight-fitting skylight or roof ventilator which could be closed by an iron chain regulated from the ground floor; the object being to exclude all air which would support combustion. In order to deal promptly and surely with an outbreak of fire, a further advantage would be obtained by the permanent insertion in the ground floor wall of a steam pipe connection, through which direct steam could rapidly fill the room, all openings in which would in the first place have to be effectively closed.

The party walls should also be carried above the roof

A drying room more up-to-date in its construction than those just described is one having a fireproof roof, and double iron doors to all openings into other parts of the factory.

Smoking Rooms.

The description of the drying room in general use applies to the smoke-houses, and frequently the two processes of drying and smoking are carried on separately in the one building, and the precautions taken to prevent hams and bacon from falling on to the fires are similar in each case.

A smoke-house with a non-fireproof firing floor is not desirable, neither is the presence of steam pipes which I have found close to the greasy wood beams.

The fuels used in smoke-houses are sawdust alone, or sawdust and oak chips, or the chips alone, and in some instances turf; in each case straw is used. The fire is laid in the centre, or around the walls, of the ground floor, and is left to smoulder for periods varying from three to 16 hours, according to the general methods adopted in different establishments. During the process of smoking, all the doors—some of iron, and some of wood with an inside sheet-iron covering and with, in the ground floor, a small observation opening—are closed, as also are the louvres and other openings.

If the weather be heavy and damp, the straw very damp, and the louvres closed, the straw will steam, and a sooty condensation will fall on and spoil the hams, &c., hence the necessity for a sloping, or an "A," roof, and louvres of an absorbent material (otherwise, iron louvres would be desirable from the point of view of external hazard) to enable this sooty condensation to trickle down the walls. The black and glazed incrustation always found on the walls of a smoke-house arises from this cause. The ventilation through louvres, or a roof board, is regulated from the ground floor by a cord or chain.

Mr. F. C. Moore speaks thus of the smoke-house hazard from his American experience :—

"The fires should be so protected that the drippings of meat cannot fall on them. *Ventilation must be provided* to prevent the accumulation of explosive gases evolved in smoke-houses. It is well known to intelligent and experienced pork-packers that meat · better cured *by a current of smoke* than by *confined* smoke.

Numerous fires have occurred from the gases formed in smoke-es. A notable instance was the explosion in the smoke-house

of Muldoon & Sharp, in St. Louis. A fire was discovered near the centre of the meat, but it was merely smoking or smouldering. Water was introduced, and explosion of the gases followed—windows and brickwork being shattered.

"Simultaneously with the report (probably from an admission of air) the flames rose in immense volumes, where before had been only dense, black smoke. The origin of this fire was attributed *to the drippings from the hams upon the fires.*"

In those bacon-curing establishments where the pig is brought in alive, money is made on the offal or waste products.

By-Products.

I recently read that the pork and beef business in Chicago does not pay, and that in 1901 the total expenses of the packing-houses were £150,244,848, and the actual amount produced by the sale of meat was just £124,263,998, and that yet on the year there was a net profit of £6,767,638. The deficit of £32,748,488 and the profit were the outcome of the utilisation of by-products, from which lard yielded £12,000,000, oils £3,000,000, hides nearly £7,000,000, fertilisers and wool over £1,000,000; and a hundred other products made up the balance. Nothing is wasted.

In Ireland, outside of Ulster, the by-products are fully utilised, the most important of manufactures being sausages, brawn (or collard head), and other tinned and preserved foods, lard, blood, and bones.

Lard and Lard Refining.

Lard is an article of considerable importance in commerce, and the imports of it into the United Kingdom were:—

In 1901,	cwts.	1,966,256,	representing	£4,037,689
1902,	,,	1,650,830,	,,	4,118,992
1903,	,,	1,732,790,	,,	3,870,774

Lard consists of 62 per cent. fluid fat (olein or lard oil) and 38 per cent. of hard fats, palmitin and stearin, and is obtained by melting (rendering) and straining the hog fat; the abdominal fat supplies the greater portion, and the finest product is prepared from the "leaf" or "flake," or, in medical language, the "diaphragm." In the preparation of inferior qualities, fatty scraps of all kinds are melted.

The fat is brought by hand from the offal cleaning room where

it has been washed, and is then placed in a mincing machine from which it is discharged in the form of a paste into a receptacle, from thence it is removed to an open iron steam-heated tray, standing on brickwork, and the product of that melting falls from iron channels at the sides and front, into a cask; it is then conveyed to steam jacketed rendering pans. After various mixings of the contents of these and other steam pans, the product becomes "refined" or "first quality" lard, and is pumped to open steam jacketed tanks in which a heat of from 55° F. to 90° F. is maintained, and from which the bladders are filled for the market. Other steam pans—some jacketed and some of a single shell—render and refine the coarser fats for other qualities of lard. The residue, termed "greaves" or "cracklings," from all the pans are sold for the manufacture of dog biscuits, and to chandlers.

In some factories, oak vats are used for rendering, with steam jacketed pans for refining; while in others all the pans are jacketed, and in many instances are wood-cased.

A pan for rendering chandlers' lard is sometimes used in the yard.

The pans above described are of open type, and have wood hoods or cowls, and flues frequently fixed over them in order to receive and carry off the vapours through the roof or windows.

Pressure Tanks or Digesters.

Some factories, especially in the North of Ireland, where a large stock of bones is on hands, because the bacon is prepared and sold without bone, have to extract the fat from bones by means of steam pressure tanks or digesters, and at a pressure of from 20lbs. to 35lbs. In addition to the usual safety valve, a small jet to relieve the pressure is provided. After sufficient steaming (varying from five to eight hours) has been done, the steam is drawn off, and water admitted on which the lard floats and is forced through the top of the digester and into receptacles for refining.

These pressure tanks are frequently embedded in the wood and grease-saturated floors, and sometimes the same conditions exist with the open rendering pans.

Direct Fire-heated Pans.

The old method of rendering by means of direct fire heat, and one which, in comparatively few instances, is still in use, is decidedly dangerous by reason of the well-known boiling-over risk. Where this method is used, the pans should be encased in substantial brickwork, and they should not be filled to within 12 inches of

their tops, while, in addition, a suspended cover that could quickly be lowered by a pulley in the event of a fire, should be provided. The room should be lofty, as fireproof as possible, and a supply of sand or earth kept ready at hand for fire-extinguishing. All fires should be put out before closing hour.

The process of lard rendering and refining, as we know it in Ireland, is practically one and the same; the only difference, so far as I have been able to ascertain, is that the temperature in the refining pans does not, as a rule, exceed 200° F., while that in the rendering pans varies from 108° F. to 230° F.

During the process, the materials have to be carefully watched and stirred to prevent their injury from burning at the bottom of the pans.

In connection with the steam rendering and refining of lard, it has been stated that in the process, explosive gases are generated which become readily ignited by contact with flame, and that therefore artificial lights should not be permitted in the lard room, and proper ventilation should be provided to allow of the escape of such gases.

It has also been said that "the recovery of fat when the question is merely one of extraction by melting (rendering), is dangerous only if direct fire heat be employed."

I have been through various lard rendering and refining rooms in which open pans (steam, and fire, heated) have been in use, and, in the majority of cases, naked gas lights—some immediately over the pans, some even inside the wood hoods or cowls, and the remainder close to the pans—have been in use for many years, while with the pressure tanks or digesters, naked gas lights close to them also exist.

Further, in all reports of which I have heard of fires in the curing establishments in Ireland, not one has originated in the lard-house whether from explosion or otherwise, and of the several Refiners and Insurance friends to whom I have spoken on this subject, and whose experience of these risks was more lengthened than mine, not one could call any instance to mind.

The explosion at Messrs. Bushire Brothers' Lard Refinery, Westmoreland Street, Liverpool, and reported in the "Post Magazine" of 12th December 1891, does not appear to have been due to ignition of vapours. The report states "the men were engaged in an upper storey feeding through a pipe a pan of fat in a larger pan of boiling water in a room below, the pans being heated

by a fire in the basement. Thirty-seven tierces of fat had been delivered when there was a sudden explosion, wrecking the place and dashing the men away, while the boiling fat was scattered in all directions. It is presumed that the inner pan burst through excessive heat pressure."

The following excerpts from "Fire and Explosion Risks" are of interest in general, and in the subject of explosive vapours in particular:—

"The article must be raised to a certain temperature before it can burn; this temperature must be sufficient to effect direct ignition, or else to generate vapour within the substances. If, when this temperature is attained, the substance furnishes inflammable vapours as the result, the *flashing-point* has been reached.

"Even then, the substance has not reached the stage of combustion, for though the inflammable vapour may have taken fire, the substance itself does not yet burn."

"The flashing-point, which chiefly applies to liquids, is the prime factor in determining the fire risk of an insured article.

"Taken separately, neither the flashing-point, nor burning-point, affords a criterion of the fire risk of a substance, the mutual relation of the two points being determinative."

"*Under ordinary circumstances, and when in a pure state, vapours are non-explosive, even though combustible.*

"Gases and vapours in general are not actually explosive except when mixed with air or oxygen, and then only when the mixture is in definite proportions. Combustible gases and vapours cannot furnish an explosion or ignition, unless the air with which they are mixed contains just sufficient oxygen—neither less nor more—for the complete combustion of the vapour present; and this quantity differs for each gas or vapour. Regarded from this point of view, the explosive gases and vapours lose a good deal of their dangerous repute, since it is but rarely that, in practice, the ratio of mixture of gas and oxygen will exactly coincide with the explosive limit, and, in fact, it is owing to this circumstance that the industrial world is spared countless explosions."

"Fats exhibit explosion risks at temperatures above 500° F."

"Fats give off vapours at high temperatures (480° F. to 580° F.), which vapours take fire spontaneously when heated to 18-20° F. above their temperature of formation. In presence of oxygen or a mixture of oxygen and air, the vapours explode.'

The flashing-points of lard and lard oil are 464° F. and 560° F. respectively, and the boiling-points are over 500° F. in each case.

To sum up, I do not consider the ordinary lard-house, such as I find it, a dangerous risk from the explosion of vapour point of view. The risk would be a different one where boiling would be done under a very high pressure.

Viewed as an ordinary fire risk, the lard rendering and refining process should, if possible, be done in a building detached from the main block, and, in order to check the flow of burning oil and grease from the former to the latter buildings, the slope of the ground should be from the main block. The pans, and, of course, all steam pipes, should be free from woodwork, and the floors as fireproof as possible. The presence of gas lights inside of the wood cowls or hoods is objectionable.

Mention might here be made of a small fire that occurred in Ireland some years ago in the premises of a knacker. Boiling of fats and bones was done in closed cylinders heated by direct fire, and some two months before the accident, a pipe from a cylinder had been inserted in the chimney-stack to carry off the objectionable odours. In the short time mentioned the stack had become lined with grease, which ignited from the boiler fire and burned very fiercely.

Lard Oil. In some bacon-curing factories the extraction of lard oil is carried on. In one such risk in the North of Ireland the weekly output of the oil averages one ton. The oil is obtained from lard by pressure and application of a moderate heat, and the residue is known as "solar stearin," an article which is used in candle-making and in the adulteration of spermaceti, &c.

No special dangers from fire or explosion pertains to the process of oil-pressing, but the oil-pressing cloths should not be tightly packed nor be carelessly left aside in a heap; otherwise the possibility of their self-ignition exists.

In its pure state, lard oil is a non-hazardous one with high-flashing and burning-points, but care is required in the use of waste impregnated with it.

In the factories under notice, greases and oil are not extracted with the aid of solvents, some of which, such as benzol, carbon disulphide, and ether, are particularly dangerous.

Remaining Miscellaneous Processes.

Blood. In the manufacture of black and white puddings and sausages, blood, meal, and fatty and other scraps are used, and their preparation needs no special comment. After disposing of the black pudding process, the blood is not further required in a curing factory, and it is sold to artificial manure manufacturers.

Bones. The bones, after having been boiled and digested under a steam pressure of from 20lbs. to 35lbs., are also sent to the artificial manure works. In some factories in the North of Ireland the bones are dried in a steam-heated chest, and reduced to a powder by means of revolving arms within it.

Intestines. These are cleaned, steamed, and prepared with salt for sausage and pudding skins, &c.

Bladders. The bladders are cleaned, and dried generally in a room moderately heated by steam pipes, and are used as lard skins.

Bristles. Some factories sell these in the wet state, and some dry them on trays over steam pipes, for sale.

Pig Skins. There is no trade for the skins in Ireland, for, in the first place, the bacon would not be sacrificed, and, in the second place, large animals with thick hides are required, and the best bacon, as a rule, comes from the thin-skinned animals.

Canned and Potted Foods. Some factories in the South of Ireland make a special feature of these preserved foods. The meat is cut up by machinery, then boiled in open pans, and also with some bones, in small digesters. The filled tins are placed in steam jacketed retorts (9lbs. to 10lbs. pressure) for steaming and air-exhausting. The tins are made and stamped by machinery, and gas-heated soldering irons are used. See Plate IV.

Packing. Bladder lard is packed in oat shellings in casks. Sometimes the shellings are hand-screened in the curing factory. Straw is otherwise used.

The boiler-house, coopers', carpenters', and other subsidiary buildings do not demand special comment.

Discursive.

Construction, &c. The general construction of the buildings of a large curing factory is of brick, stone, and sometimes partly of wood, and with roofs of slates, corrugated iron, and felt. As a rule, with the exception of stables, workshops, and some stores, the buildings form one risk with direct or indirect communications.

Lighting. Coal gas, and/or electric incandescent and/or arc lamps, are now in use; the electricity being frequently generated on the premises. In the chilling and other rooms, where moisture more or less is always present, the electrical wiring should be of a very special character and put up under careful supervision; wood casing should not be used.

The use, in the upper floors of some smoke-houses, of the moveable plug lamp is objectionable, by reason of the rough usage to which the insulation is liable.

Sawdust. Owing to its known liability to spontaneous combustion, sawdust should be stored in as dry a state as possible, and also kept free from oily or greasy matters. Mr. Edward Atkinson, the well-known American underwriter, states that "sawdust impregnated with a very little animal or vegetable oil or grease is a most deadly and certain incendiary."

Saltpetre (Nitrate of Potash). This article, used in pickling, is in itself harmless, but dangerous combinations will result if it be stored with oil, tallow, or other greases. Again, water thrown on heated saltpetre will cause an explosion. The saltpetre usually comes into the factories in wood kegs; this method of packing is preferable to that of the fibrous bags which will rapidly burn on the application of a light or burning substance.

In a North of Ireland factory a blaze was once caused by a lighted match having been thrown on a keg-top on which some saltpetre mixed with sugar had been placed.

Fire-extinction. This has been somewhat dealt with in connection with the drying-houses. As regards the lard and oil extraction houses, water should not be used to extinguish a fire inside of the building, for, in the first place, it would spread the fire by conveying the floating burning materials elsewhere, and, in the second place, its action on

burning fats and oils could generate an explosive gas. Earth, sand, and ashes are recommended for such fires in the open; and chemical extincteurs, exclusion of air, and the turning on of steam *where practicable*, for interior fires.

Salvage. It need scarcely be said that the nature of the stock is such that prompt measures would be necessary in the handling of the salvage in the main portions of a curing factory.

Fires. I had hoped to deal somewhat fully with fires and their causes, but the want of satisfactory data stood in the way and led me to refrain from detailing special cases. From the particulars obtained, the largest losses appear to have occurred in the pork and packing houses of the United States, and in Ulster as regards Ireland.

It will, I believe, be generally admitted that the majority of losses have originated in the drying and smoking houses in consequence of the meat and meat drippings falling on to the fires. These houses should be properly cut off from the adjoining buildings. The theory adduced for a fire at 3.20 a.m. on 25th April, 1902, at a Londonderry curing factory, and which resulted in a loss of £5,000, was the contact of nests of mice with steam pipes.

I record with pleasure my thanks to Messrs. J. & T. Sinclair, Messrs. Walkington & Son, Mr. C. R. Topping, and Mr. Samuel Moore, all of Belfast; to Messrs. J. Matterson & Sons Ltd., Messrs. James O'Mara & Sons, both of Limerick, for valuable information given; and special thanks are due to Messrs. W. J. Shaw & Sons, of Limerick, for having taken special trouble to give me all desired information. I have also found the following useful:— Mr. A. W. Shaw's contribution to "Ireland: Industrial and Agricultural," Mr. Wm. A. Harris's Fire Insurance Dictionaries and Dr. Von Schwartz's "Fire and Explosion Risks."

INDIARUBBER AND PNEUMATIC TYRE FACTORIES.

By ROBERT CUMMING, General Manager, Scottish County and Mercantile Insurance Company, Limited.

A Paper read before the Insurance Society of Edinburgh, 15th November, 1904.

IN the first place, I wish to express to our esteemed secretary and the office-bearers generally my thanks for the privilege of reading this paper before you. Prior to taking up the subject at the request of the former gentleman, my ignorance of it was simply colossal, whatever it may be now, and therefore, whether or not anything that may be said to-night gives information to the hearers of it, it is certain that one person has derived benefit by the acquirement of the knowledge, little though it may be, necessary for the writing of even the baldest and worst possible paper on a subject even now of very great interest and likely to be of even more interest from a commercial point of view as time goes on.

As far as I am aware, this is the first paper dealing with the manufacture of rubber in its fire insurance aspects, and I intend, therefore, to take the liberty of making it, as far as I can, exhaustive, even at the risk of being exhausting, and begin by dealing first with the substance itself.

Indiarubber, or caoutchouc, is the dried coagulated milky juice of various trees and shrubs belonging to the natural orders Euphorbiaceæ, Moraceæ, Artocarpaceæ, Apocynaceæ, Ulmaceæ, and Asclepiadeæ, but there is an appreciable difference between the products of even species of the same order not only in regard to quantity but in quality as well; the quantity of commercial indiarubber depending not solely upon the plant producing it, as many other determining causes may intervene to increase or diminish the yield of the "latex," as the juice is called when it flows from the tree.

Before proceeding to deal with the chemical aspects of the wonderful substance we are considering, it is worth while to turn to the history of its discovery and adaption to the many everyday uses in which we now see it employed, ranging from insulating material for submarine cables to pocket combs and paper knives.

Rubber is first mentioned by Gonzalo Fernandes d'Oviedo y Valdas in his "General History of the Indies" (Madrid 1536), where he refers to "The Indians' game of Batey, which is the same as the game of ball, although it is played in a different manner, and the ball is made of a different substance from that used by the Christians." Father Charlevoise, a Jesuit priest, describes the *Batos*, a species of ball of a solid matter, but extremely *porous and light. It soars higher than our balls, falls on the ground and rebounds much higher than the level of the hand which quitted it; it falls back again, and rebounds once more, although not to such a height this time, and the height of the bounces gradually diminishes.* Antonio de Herrera Tordesillas (1549-1615), in his "General History of the Voyages and Conquests of the Castilians in the East Indies," speaking of the balls used by the Spanish Indians first alludes to their origin from "the gum of a tree." The same author, writing about the conquest of Mexico quotes, as one of the peculiaritiesof Cumana, certain trees which, when punctured, yield milk, changing into gum with a fine smell. Jean de Torquemada, in his book "De la Monarquia Indiana" (Madrid 1615), first mentions a rubber-yielding tree by the name of "Ulequahuitl," a name still used by natives of Mexico to designate the Castilloa Elastica. The Spanish conquerors used the substance procured from the tree to waterproof their cloaks, but found that though impermeable by water, solar heat greatly affected them. Between this time and 1736, some rare samples of the elastic product reached Europe to adorn the cabinets of curio-seekers. It was worth a guinea an ounce. In the last named year, La Condamine, an eminent Frenchman of science, sent to the neighbourhood of the equator in Peru and Brazil by the French Government on a geographical expedition, sent home to the French Academy some rolls of a blackish, resinous mass, known as "caoutchouc." He also sent a memoir with it dealing at considerable length with its properties, and the methods employed in gathering it, and amongst other things says: "The use which is made of this resin by the nation of the Omagnas, situated in the middle of the American continent, on the banks of the Amazon, is still more singular; they

make bottles of it in the form of a pear, to the neck of which they attach a fluted piece of wood. By pressing them, the liquid which they contain is made to flow out through the fluted piece of wood, and by this means these bottles become real syringes." That is the origin of the name given by the Portuguese to the rubber-yielding tree "Pao de Ciringa" and also to the name given to the harvesters of the gum of "Seringarios."

In 1751 the French Academy published the researches of Fresnau, an engineer residing at Cayenne (an island of French Guiana) who continued the work La Condamine was forced to give up, and who seems to have foreseen all the future importance of indiarubber. He studied the real source of the supply, and after much arduous toil at last discovered among the Coussaris Indians the long-sought tree. Describing Indian methods of collecting indiarubber, he says—"They commence by washing the foot of the tree, then they make, with a bill-hook, longitudinal but rather oblique incisions which should penetrate the whole thickness of the bark, taking care to make them one above another in such a manner that what flows from the top incision falls into the one underneath, and so on, until the last one, at the bottom of which a leaf of the Balisier (an American reed) is placed, which is made to hold the liquid by potter's earth, so as to lead the juice into a vessel placed at the foot of the tree."

He gives further details of the processes by which rubber is prepared for the market, but these as well as the above-mentioned process are so much like the processes still in vogue that I need make no further reference to them at this point.

The publication of the result of the researches of La Condamine and Fresnau induced the French botanist Fuset-Aublet to start for Guiana in 1762, and two years afterwards this man of science published his "Flora of Guiana," in which he made known the botanical details presented by the indiarubber tree, to which he gave the name of *Hevea Guyanensis*.

A doctor of medicine in Prince of Wales Island, James Howison, was the first to determine the species that was later called *Urceola Elastica* by Roxburgh, who himself discovered in the forests of the Brahmaputra in Assam, the *Ficus Elastica*, and finally Coffigny was the first to announce the existence in Madagascar of a sarmentose plant of the jasmine species which furnished a milky juice yielding, on thickening, an elastic juice like indiarubber.

While botanists were carrying on their researches, chemists and

others were at work to find means of making use of the raw material brought before them. In 1768 Herrissant and Macquer simultaneously memorialised the Paris Academy on the subject and enumerated Dippel's animal oil, spirits of turpentine, and pure ether as bodies capable of dissolving rubber, which is insoluble in water or alcohol. They proposed to make surgical probes and small laboratory tubes of it. In 1770, Dr. Priestley, an English chemist, called the attention of the scientific, or more properly art, world, to the use of indiarubber for effacing pencil marks, stating that it was sold in cubical pieces of half-an-inch for three shillings each. In 1772 Magellan introduced the substance into France, and as far back as 1775 small cubes of rubber were on sale at stationers' shops, and called in France—*peaux de negres* (niggers' skins), and in England—*indiarubber*, a name still persisting.

In 1780 the experiments of Berniard, a French chemist, continued the work of Macquer and Herissant, and forecasted the many uses to which indiarubber would some day be put. Fourcroy (1735-1809), Berthollet (1748-1822), and Giobert carried on experiments, and Grossard demonstrated the best method of making bottles, tubes, and the like by using thin, narrow strips of rubber. Besson (1791), Johnson (1797), Champion (1811), and Clark (1815) made attempts of varying degrees of success to make waterproof clothing, and in 1820, Nadier, an English mechanic, discovered means by which indiarubber could be cut into thread and elastic fabrics woven from it to take the place of small spiral springs. At last in 1823, Macintosh, founder of the well-known firm still flourishing in Manchester, and whose works I recently visited, discovered and applied a solution of indiarubber in coal tar naptha and thus created the waterproof garment industry which took the name of the inventor. But the problem of the best use of rubber was not yet solved. The early macintoshes were even more remarkable for their powers of adhesion in fastening their unlucky wearer to his seat at inopportune moments than for their waterproof qualities, and for some years were productive of more bad language than anything else. In 1836 Thomas Hancock found that rubber, cut into small strips or shredded and submitted to energetic kneading under the influence of moderate heat, could be reduced into thick masses, that its elasticity could for the moment be suppressed, and that in this state it could be moulded into any desired form. The manufacture of rubber

articles was thenceforward a solved problem, and the discoveries of Rattier, Guibal, Aubert, and Gerard came in quick succession and caused the industry to make rapid progress.

The uses of rubber would have remained comparatively few but for the wonderful discovery of vulcanisation, which opened up an entirely new range of possibilities. Ordinary rubber objects are subject without exception to a great defect arising from the deterioration of their elasticity under different circumstances and conditions. Rubber is very elastic at ordinary temperatures; a thread may be stretched to five or six times its original length and when the stretching force is removed return to its original size. Cold, however, causes it to lose this property, and if stretching is attempted, the rubber breaks. At summer heat this elasticity is restored. Natural rubber, too, is very adhesive, especially to itself, and this property is useful in indefinitely enlarging threads and sheets. At summer heat this adhesiveness increases and the rubber becomes sticky and pitchy, giving off at the same time a very disagreeable smell. These qualities were fatal to the success of the first attempts at waterproof garments, and natural rubber macintoshes were soon abandoned.

In 1832 the German chemist, Ludersdorf, was the first to discover that *sulphur* removed the viscosity of indiarubber dissolved in turpentine; at about the same time, Hayward, an American, used sulphur to powder indiarubber sheets and thus lessen their stickiness. But neither of these investigators pursued their researches to their natural end, and to Nelson Goodyear is due the solution of the problem of the production of a preparation of indiarubber, neither brittle at low temperatures nor sticky at high temperatures, by methods commercially applicable. In 1839, Goodyear found that by mixing rubber and sulphur and exposing the mixture to a fairly high temperature a substance was produced, elastic over a very wide range of temperature (from below freezing to 248 degrees Fahrenheit) and highly resistant to most chemical re-agents. This process is called vulcanisation, and its discovery gave an impetus to indiarubber manufacture that has continued ever since. Other methods of vulcanisation were found possible, by Parkes among others, who had in 1843 found in carbon bisulphide a better solvent for rubber than any previously known. Parkes also was the first to discover a process of desul-

phurising rubber waste, and finally (1858), after Hancock had in 1846 patented a method of moulding rubber objects, an invention which was the origin of full moulds (buffers, valves, belts, etc.), then of hollow moulds (mostly toys), Goodyear carried the process of vulcanisation further and produced hardened rubber or ebonite, a horny mass not unlike ivory.

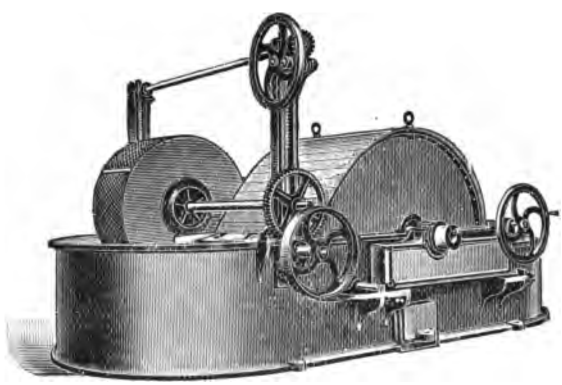
It would serve no useful purpose to go into the geographical distribution of rubber-yielding plants in detail now, but in the exhaustive work of Messrs. Seeligmann, Torillhon, and Falconnet, French experts in various branches of rubber manufacture, any who wish to inform themselves fully will find as much material as the most ardent inquirer can desire. Suffice it to say that a moist, warm climate is essential, and that the zone extending from 30° north latitude to the same degree of south latitude fulfils the necessary conditions, but the finer varieties of rubber are only to be found within the narrow zone of 3° 50′ north to 1° south, where the temperature ranges from 66° to 90° Fahrenheit with a very moist atmosphere. These limits are well within the isotherm of 80° Fahrenheit.

For want of time I must pass over many interesting details of the attempts, successful and otherwise, to acclimatise rubber plants in new countries, and also many particulars as to the method of gathering and preparing the raw rubber for shipment. It must be mentioned, however, that in some districts the tree is felled, instead of being bled to secure its latex, and though the latter process, pursued injudiciously, is injurious, the former is fatal, and, unless the tree is past its best, a most wasteful process. The exceedingly unhealthy climatic conditions that prevail in most rubber-producing countries militate against scientific methods, but until these are largely introduced the production of rubber will less and less meet the demand for it, and the price is likely to rise as it has done for some years back. I cannot help thinking that the scientific production of raw rubber offers a very favourable field for the consideration of the progressive capitalist.

For full details as to its solubility and other physico-chemical properties both in the raw and vulcanised state, a reference to the work already mentioned, of which an English translation (by Mr J. G. M'Intosh, lecturer at the Polytechnic, London) was published in 1903, "Indiarubber and Guttapercha" (Scott, Greenwood, & Co., 19 Ludgate Hill, E.C.), will supply all that

can be desired, either in information on the actual points as to which light is sought or by mentioning the source from which further particulars may be obtained.

Raw rubber reaches this country in a variety of forms, and its principal peculiarity some years ago was the extent of the adulteration to which it was subject. Water, earth, sand, vegetable debris, stones, and even, I understand, occasional half bricks helped to add to the rubber (?) production in the hands of the innocent Indian, but now all the balls or lumps of rubber are cut open at or previous to reaching the place of exportation and consequently only reasonably pure rubber reaches this country. To show the great progress of the industry, I may mention in passing that the imports into Britain in 1830 reached only 23·2 tons, while last year (1903) they were no less than 24,305·25 tons, of a total value of £6,743,866 sterling; while the imports



WASHING AND BREAKING ENGINE (Messrs. James Bertram & Son, Ltd.)

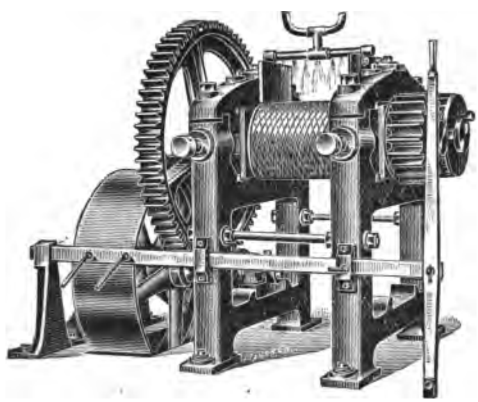
for the first eight months of this year (1904) into the United States were nearly 30,000 tons, and the value, roughly, £8,000,000 sterling.

To give some idea of the rapid increase that has taken place in the value of rubber within the last few years, it may be stated that the price per pound was, in February 1902, 2s. 11d., and in December 1904, 5s. 5d. The increase was not, however, quite continuous, several cases of small decreases having occurred between the dates given above.

The usual first process to which raw rubber is subjected on its arrival at a British factory is that of softening or superficial washing, by keeping it for from twelve to twenty-four hours

in a bath of warm water. The rubber is then sliced by hand or mechanically, and as in the latter case water is a usual adjunct, neither of the processes presents any features specially undesirable from a fire insurance point of view, nor does the storage of raw rubber under suitable conditions. The next process is shredding and complete washing performed by rolling machines, and accompanied by a copious supply of water.

After proper washing the shredded sheet or lacework contains no foreign substance except water, and to complete the washing process it is only necessary to dry it. This is done by stretching the "skins," as they are called, on tight iron wires, or in some cases in stoves at comparatively low temperatures (not

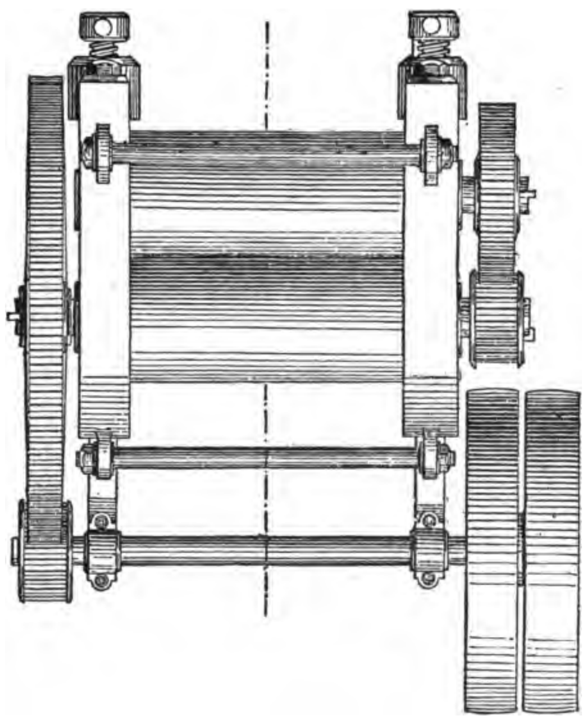


WASHING ROLLS (Messrs. James Bertram & Son, Ltd.).

more than 140 degrees Fahrenheit). The drying sheds or stoves require to be well ventilated, and as dark as possible, as exposure to light has a deleterious effect on rubber. After drying, the sheets are folded or rolled, and warehoused in a dry, dark place till required for further treatment. There is considerable loss of weight during washing, varying from 15 to 20 per cent. for high-class rubbers, to as much as 60 per cent. in inferior qualities. Para rubber is the best.

In most modern factories the rubber is next masticated or mixed, and as a high temperature would spoil the rubber, there is no special fire hazard in this process either. After this process the rubber takes the form of thick irregular slabs, and in some factories so important is this work considered that different qualities of rubber, particularly African rubbers,

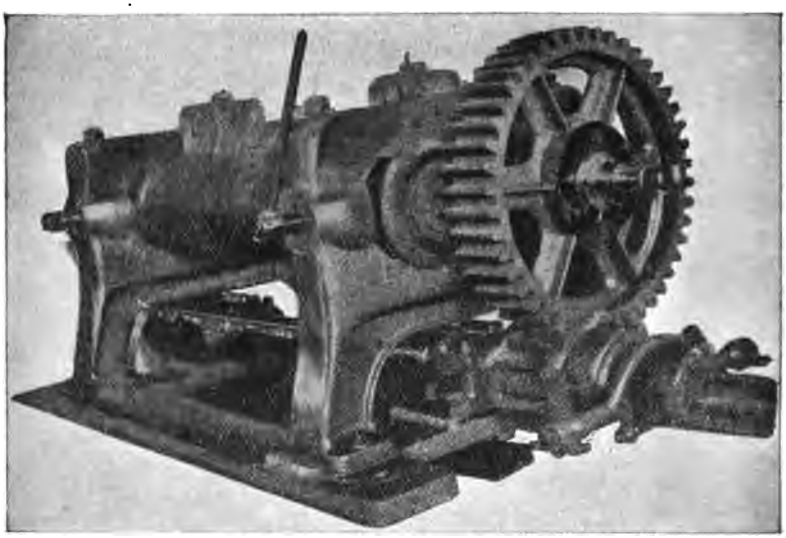
are dealt with separately. The rubber is next mixed with sulphur, sometimes at the end of the mixing or masticating process, sometimes in a different operation, the proportion of sulphur depending upon the use to which the rubber is finally destined in its vulcanised state, and any other substances required for colouring or other purposes are also introduced. The masticated rubber is then formed into regular-shaped plates or blocks by passing through hot rolls (176 degrees Fahrenheit), the blocks varying in thickness according to the end in view.



MIXER—HORIZONTAL ROLLS (Plan) (Messrs Scott, Greenwood & Co.).

Blocked rubber is then stored, and during storage the rubber, somewhat uneven, and in parts stringy at first, becomes of equal texture throughout, and assumes the form of the mould in which it is placed. From block rubber is manufactured sawn sheet and English sheet rubber. By various different machines, all on practically the same principle, and only differing in detail, the blocks are sawn into sheets ranging in thickness

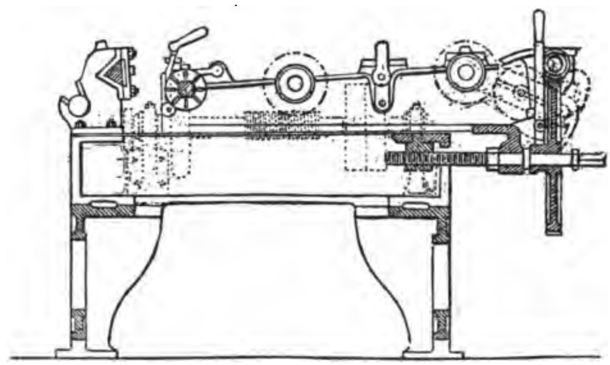
from 4·15 down to 0·18 millimetres. From sheet rubber many different articles are easily made. If edges cut slightly obliquely are pressed together, especially if a brush dipped in benzol has been run over them, they will form a perfectly homogeneous joint on being struck with a small round-headed hammer. Joint is perhaps hardly the correct word to use. The two edges become as completely united as if no division had ever existed. Before articles so made can be put upon the market, however, they must be vulcanised, or they would be subject to the various defects of pure rubber already referred to.



Large Calibre Mixer (Messrs. Scott, Greenwood & Co.).

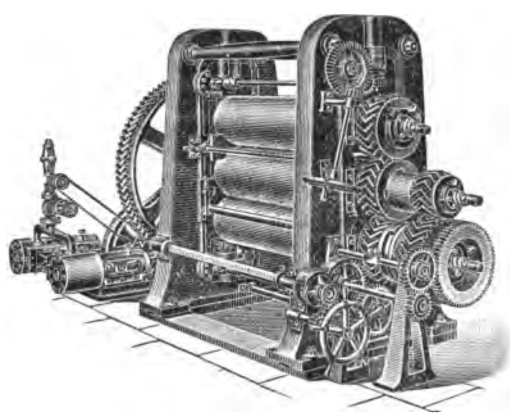
Blocks may be converted into sheets also by lamination or pressing. For this process the cake, when it becomes sufficiently homogeneous in the mixer, is passed while still warm into a calendar. (In passing, it is well to mention that considerable heat is developed by the friction of the rubber in the rolls of the mixer, and that as varying degrees of heat are desirable in the process, according to the purpose for which the rubber is destined, the rolls are hollow, and may be filled with hot or cold water at will.) The rolls of the calender are generally made of steel, and are heated during the whole process, as a

result of which the block is reduced to a sheet of the desired thickness, and in properly made rubber, entirely free of the serious defect of air bubbles. There are also friction calenders in which the rolls revolve at different speeds, and which are



MACHINE FOR CUTTING CONTINUOUS SHEETS OF RUBBER (Elevation) (Messrs. Scott, Greenwood & Co.).

generally used to apply a thin sheet of rubber to canvas and other fabrics for the manufacture of hose pipes, transmission belts, outer tubes of pneumatic tyres, etc. After a fabric has been treated in this way a thicker layer of rubber may be put

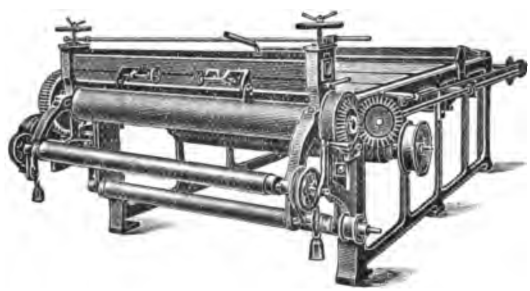


CALENDER (Messrs. James Bertram & Son, Ltd.).

on by passing it through a calender again. There are also calenders which coat both sides of fabric with rubber at one process. By the use of special rolls, laminated sheet is made to imitate the appearance of sawn sheet, for though the former

process may be carried on all the year round and the latter cannot, the superior qualities of sawn sheet for many purposes enable its manufacture to be continued in spite of its greater cost.

The laminated sheet has only comparatively recently been used in the making of rubber thread. Formerly raised sheet was used, an excellent but costly method. The process of raising consists of repeated application of thin coatings of rubber by evaporation of a rubber solution to any suitable fabric, until the required thickness of rubbe is attained. The sheet is then treated with talc and the rubber detached (by moistening with a little solvent) and rolled on a winder. By Sollier's



SPREADING MACHINE (Messrs. James Bertram & Son, Ltd.).

process, and by casting sheets on glass, the disadvantage of having one side of the sheet marked by the threads of the fabric on which it is raised is avoided. In the last mentioned process a very dilute solution of rubber in bisulphide of carbon (1 of rubber to 15 of carbon bisulphide) is used, and care must be taken that the process of evaporation be not too rapid, or the deposit of drops of water on the surface of the sheets would spot and spoil them.

Before proceeding to treat of vulcanisation, it is perhaps better to deal with the chemical composition of rubber, and its action when exposed to various re-agents. Rubber is a hydrocarbon of somewhat uncertain composition, as its exact analysis presents peculiar difficulties to the chemist. The leading article on the subject in the "Encyclopædia Britannica" gives its symbol as probably $(C_{10} H_8)x$, but states that there are no data for the determination of the value of x in this formula. The French work to which reference has already been made states that the correct formula of the fundamental carbide from which rubber is derived is $C_5 H_8$, and that rubber may thus be considered as a mixture of

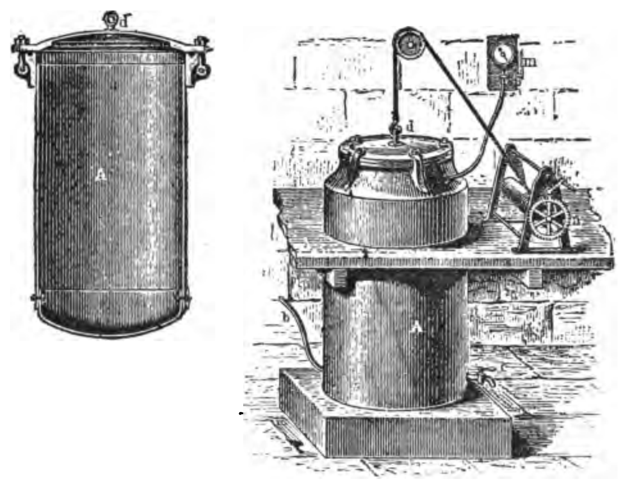
polymeric carbides of high equivalents. In the Journal of the Society of Chemical Industry (30th January, 1904) the formula is given as $(C_{10}\ H_{16})x$, and it is remarked that the x is likely to be replaced by the figure 10. At all events all the varieties of rubber are terpenes or polyterpenes, which, under the influence of atmospheric oxygen and light, partially change into resinous bodies and yield the rubbers of commerce.

Dilute acids or caustic alkalies have little effect on rubber. Concentrated hydrochloric acid, both in the liquid and gaseous states, attacks rubber, but the change it undergoes is but little known. Nitric acid attacks it feebly at low temperatures, energetically at high, colouring it yellow at first, afterwards turning it into a greasy-looking body from which nitrogen is disengaged, and finally converts it into carbonic acid and oxalic acid. By prolonged ebullution the greasy-looking substance is converted into campho-resinic acid. The nitrious vapours act very violently, and rapidly decompose it. Concentrated sulphuric acid acts upon rubber as it does upon cork, and clears the surface even at low temperatures. At high temperatures decomposition is very rapid, with release of sulphurous acid and carbonic acid. A mixture of sulphuric and nitric acid attacks rubber very energetically. Hydrofluoric acid and the organic acids have no action on the rubber.

Chlorine in its gaseous state exerts a very energetic action on rubber, impairing its elasticity, and finally making it hard and brittle. Iodine and bromine exert an effect analagous to that of sulphur, the former being more energetic in its action.

Sulphur is the most important substance of all in the rubber industry, next of course to the rubber itself, and by its use the practically endless varieties of substances adapted to make objects of every description has been rendered commercially possible. If rubber is mixed with either pure sulphur, the alkaline sulphides, the sulphides of alkaline earth, the metallic sulphides, or chloride of sulphur, and the mixture heated, the sulphur is more or less absorbed. According to the quantity of sulphur absorbed and the amount of heat to which the mixture is exposed, the rubber becomes transformed into more or less hard and elastic substances named, in accordance with the existence of these qualities, vulcanised rubber, hardened rubber, ebonite, etc., etc., and all these substances are entirely free, within a very large range of temperature, from the disadvantages inherent in raw rubber.

Raw rubber may, it is true, be vulcanised by the use of other agents than sulphur, such as the halogens, but these bodies are so much more volatile than sulphur at ordinary temperatures, and their action is so much more energetic, that great difficulty exists in obtaining satisfactory results with them; thus sulphur—cheap, easy to handle, and commercially satisfactory in its results—is by far the most extensively employed substance to obtain the valuable rubber products above mentioned. There are quite a number of different processes of vulcanisation all in daily use, but as the highest temperature necessary in any of them does not exceed 320 degrees Fahrenheit, none of them present, under normal circum-



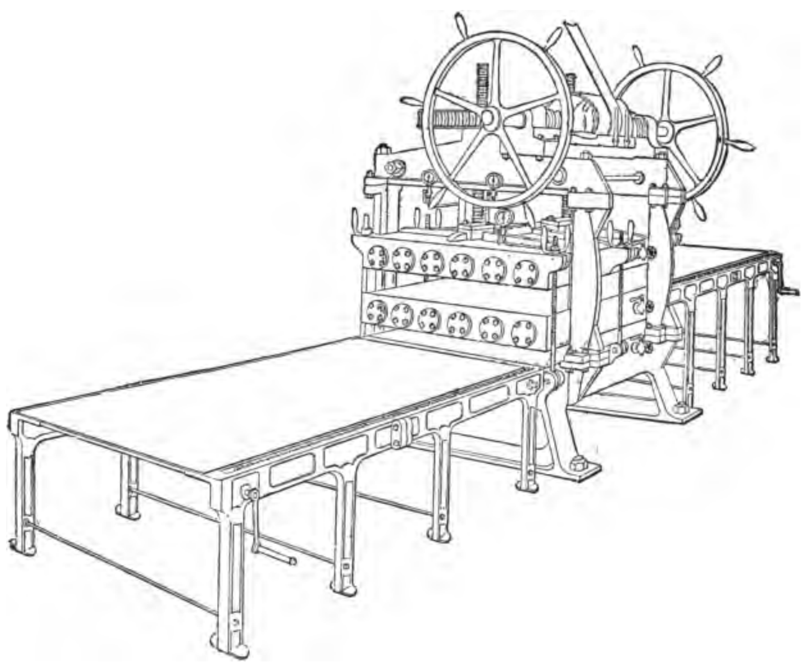
Apparatus for Vulcanising Small Objects by High Pressure Steam (Messrs. Scott, Greenwood & Co.).

stances, any special fire hazard. There is some doubt as to what the process of vulcanisation really is from a chemical point of view, but there is certainly some ground for believing that ebonite is the product of complete vulcanisation, and that the softer products are obtained by arresting the process at various stages.

Vulcanised rubber may be coloured in various ways by the addition of suitable pigments, and may be also deodorised, but the last process, unfortunately, yields only temporary results. Rubber in this state is a bad conductor both of heat and electricity, and for this reason, along with other properties, it is particularly suitable for use as an insulating material. It also resists most chemical re-agents better than normal rubber, but certain of the

metals, particularly iron, copper, and certain alloys, exert a powerful corroding effect on, and are reciprocally corroded by, vulcanised rubber; and for this reason, in electric cables, the rubber is not allowed to come into contact with the copper conductor.

And now, finally, a few minutes must be spared to consider the fire hazard of rubber works more closely than has been done in the passing comments already made while treating of processes. In the first place, it is quite certain that the greatest factor of risk is



VULCANISING SCREW PRESS WITH THREE PLATES
(Messrs. Scott, Greenwood & Co.).

not the rubber itself but its solvents, of which mineral naphtha and carbon bisulphide are the most common. The former is a volatile substance, giving off a highly inflammable vapour at ordinary temperatures. This vapour, mixed in certain proportions with air, gives not only an inflammable but an explosive mixture, and, consequently, the methods of handling and keeping naphtha are points to which the fire insurance surveyor must devote particular attention. It is worth noting, however, that once the

rubber is dissolved in the naphtha the inflammability is much reduced, though one fire in the thirty-nine occurring in the ten years 1894 to 1903, of which particulars appear in the annexed appendix, is stated to be due to the dropping of a match into solution. The loss, however, was small. In the *Indiarubber Journal* of 23rd November, 1903, there is an interesting article on this subject, but dealing with it particularly in regard to the question of carriage by rail. The details of an experiment to show the comparatively slight risk of fire arising from flames quite close to a quantity of solution (15 per cent. rubber and 85 per cent. naphtha) are given, but the conditions are hardly severe enough to justify any very definite conclusion. This same article, however, throws a very interesting sidelight on the dangers of another substance used in rubber works—namely, carbon bisulphide or bisulphide of carbon, as it is pointed out that vapour from the latter substance is of great specific gravity, and will accordingly, if opportunity offers, run along a table or a floor until it reaches a flame, and will then transmit a fire with the rapidity of gunpowder. Bisulphide of carbon, therefore, must be most carefully looked after, and any carelessness in its storage or use is bound to lead to disaster. It is interesting to note that only one of the forty-three fires, of which details appear in the appendix, has had ignition of bisulphide of carbon as its cause, and that is a case of electric sparking in a roller machine during dry vulcanising by bisulphide of carbon. Some of the twenty-one fires whose cause is unknown may have been due in some measure to bisulphide of carbon, but I am inclined to think that, like gunpowder and other explosives, its danger is so obvious, not only to property but to persons, that the very great care necessitated by this factor, to a very large extent compensates for the physical hazard. There is further to be taken into consideration the very strict regulations of the Home Office under the Factory Acts as regards the use of carbon bisulphide, which, though only intended to prevent injury to the health of the operatives, also reduce the fire hazard.

There are also risks arising from the various fabrics that are used for the foundations of various rubber goods, but these risks are various as the fabrics, and cannot be dealt with properly within the four corners of this paper. Their use in conjunction with rubber presents no special features, at least as regards the class of works which have been brought forward for your considera-

Cycle tyre factories only differ from other rubber works in

that the fabric they use in connection with rubber is almost invariably canvas, which presents no special or undue features of hazard. It may be added, also, that there is a distinct class of rubber works which I have not dealt with at all. These works use waste or recovered rubber—crumb rubber, as it is called—as their basis of production, and as this means that mixtures including cotton and similar substances, often in a dirty and greasy state, are dealt with, the risks of spontaneous combustion, for one thing, are much greater. Messrs. C. Macintosh & Co., with an experience dating back eighty years (to 1824), have no case of spontaneous combustion, and only one of the forty-three cases from 1st January 1894 to 26th August 1904 is attributed to this cause, so that in crude rubber factories the risk of fire from this cause is not great.

It is estimated by a gentleman well qualified to give an opinion on the subject that there are about one hundred works in the United Kingdom for the actual manufacture of indiarubber goods, but as there is no satisfactory list of such works in existence—many firms describing themselves as manufacturers who are not actually such—it is not possible to give any here. The principal centres of the manufacture are, however, London, Birmingham, Manchester, Glasgow, and last, but not least, Edinburgh.

And now, in conclusion, I must express my obligations for assistance and courtesy to Mr. Stronach af the Advocates' Library, Mr. Woodburn of Messrs. R. & R. Chambers, Messrs. Gooding and Hale of the Dunlop Rubber Company, Mr. Clay and the Directors of C. Macintosh & Co., Ltd., Mr. James Kerr of the Surgeons' Hall (to whom the Society is already deeply indebted), Mr. J. M. Barr, Messrs. M'Tear & Co., Messrs. Cruickshank, Son, & Co., Messrs. Brocklehurst & Son, Mr. A. B. Dansken, Messrs J. Goodear & Sons, Messrs. Thomas Howell & Co., the "London and Lancashire," "Northern," "State," and "Union" Insurance Companies, to numerous other individuals, firms, and companies, for negative information, very valuable in itself, but supplied by so many that I must ask to be excused from giving their names; to Messrs. Scott, Greenwood, & Co., for permission to use blocks from "Indiarubber and Guttapercha," and to Messrs. James Bertram & Son, Ltd., for blocks of machinery made by them; and last, but not by any means least, to you, Mr. Chairman, and to you my patient auditors, for bearing with me so long. I thank you, one and all, sincerely.

APPENDIX.

List of Fires in Rubber Works for Ten Years 1894–1903 (inclusive).

No.	Amount of Loss.	Cause.	Originated in.	Extinguished by.
		1894		
1	£4300	Supposed ignition of fluff		
2	650	Unknown	Rubber store	Fire Brigade
		1895		
3	750	Unknown	Drying stove	
4	510	Waste rubber igniting	Outside building	Fire Brigade
5	70	Unknown	Drying room	Workpeople
		1896		
6	17	Waterproofing ignited through friction of rollers	Steam engine room	
7	70	Overheating steam pipe		
8	10	Unknown		
		1897		
9	430	Unknown		
10	250	Unknown		
11	440	Spontaneous combustion	Attic	Sprinkler
		1898		
12	1560	Naked light ignited oloth	Warehouse	Fire Brigade
		1899		
13	6875	Supposed men smoking		
14	170	Oily waste ignited		
15	100	Gas explosion	Deodorising stove	Works Brigade
16	400	Unknown	Refrigerator room	Fire Brigade
17	235	Unknown, probably smoking	Drug store	Fire Brigade
18	35	Electric sparks in cloth printing machine.	Spreadiug room	Workpeople
19	25	Match dropped in solution	Solution shop	

LIST OF FIRES IN RUBBER WORKS FOR TEN YEARS, 1894–1903 (INCLUSIVE)—*continued.*

No.	Amount of Loss.	Cause.	Originated in.	Extinguished by.
		1900		
20	£5	Unknown	Motor fan	
21	1765	Unknown	Drying room	Fir Brigade
22	1060	Unknown		
23	10	Friction in spreading machine	Cycle tyre rooms	Workpeople
24	40	Electric spark in rollers during dry vulcanising by bisulphide of carbon	Liquor curing shed	Workpeople
25	985	Unknown		
26	6600	Unknown		
27	13,875	Unknown	Vulcanising room	Brigade
		1901		
28	610	Unknown	Probably in old rubber goods store	
29	70	Supposed friction	Spreading room	Workpeople
30	45	Unknown		
31	330	Can of naphtha upset		
32	2	Overheating of drying stoves		
		1902		
33	25	Ignition of vapour off cloth by friction with rollers		Workpeople
34	650	Unknown	Warehouse	Fire Brigade
35	95	Unknown		
		1903		
36	380	Unknown		
37	70	Friction of mixing rolls	Mixing mill	Fire Rrigade
38	325	Naphtha fumes ignited from watchman's lamp	Spreading room	Fire Brigade
39	20	Friction in spreading machine	Spreading room	Machineman
		Particulars of Four	**Fires in 1904.**	
40	2900	Unknown	Ball painting and box making	
41	20	Hot ashes near wooden tank		Workpeople
42	2580	Unknown, believed to be light thrown among combustible materials	Yard	Fire Brigade
43	615	Unknown, possibly overheating	Drug rooms	Fire Brigade

N.B.—This list is not to be taken as exhaustive.

HOSIERY FACTORIES, WAREHOUSES, AND DRESSING WORKS.

By C. R. WALTON CLARKSON.

A Paper read before the Insurance Institute of Nottingham, 20th January, 1905.

In opening this paper I must first express my appreciation of the honour which you have conferred upon me by entrusting me with its preparation, and ask your indulgence for its imperfections, the time which I have been able to devote to it having been all too short.

I have found it convenient to treat the subject under several headings, and after giving a brief description of the yarns and the finished fabric, to deal first with the factories and warehouses, and then with the dressing works.

Yarns. There are very many different yarns used in the hosiery trade, but for our purpose they may be divided into the following classes:—

Wool.—These are yarns made from pure wool, such as lamb's-wool, worsted, cashmere, and bottanys.

Wool Unions are yarns composed of cotton and wool, either mixed before spinning, such as merinos and angolas, or made by doubling threads of the two materials, such as cordons. These yarns may contain any percentage of wool, from 95 to 2 per cent., and the amount is indicated by numbers denoting the percentage, the first number always referring to the wool, a 75–25 yarn being three-fourths wool and one-fourth cotton.

Cotton.—The yarns composed entirely of cotton include American yarns, Egyptian yarns, Lisle thread, mercerised cotton yarns, and coloured dry spun cotton yarns.

Silk.—There are two classes of silk yarn, one known as silk yarn, prepared by doubling long strands of silk, and the other known as

spun silk yarn, manufactured from short silk fibres by spinning, the latter class being cheaper and more commonly used. These yarns are used in forming designs in fancy fabrics of other materials and also for the manufacture of silk underwear.

Silk Unions.—Silk may be mixed with cotton or wool in the same manner as wool and cotton.

Shoddy.—There are several kinds of yarn which are made from the short waste fibres from woollen and worsted mills, and also from rags, and these yarns can only be prepared by spinning them with a heavy oil, and cannot be scoured until they have been made up. They may contain 10 to 30 per cent. of oil—possibly more—and sometimes a small or large percentage of cotton to strengthen them. Those most generally met with are the low lamb's-wools used in the manufacture of underclothing, which is afterwards scoured, and the low black wools, from which the cheapest cardigans are made. These are not scoured, and in wear vie with cheap corduroys for effluvia.

There are also yarns, sometimes known as "imitation" yarns, which have a woollen feel and appearance, and are made from low quality cotton loosely spun with a small percentage of oil, and in some cases with a little wool. They are chiefly used in the manufacture of the lowest classes of hose.

Elastic.—For surgical bandages, stockings, &c., a cotton or silk covered indiarubber thread is used for making a knitted fabric, but this is really a distinct trade, and, as far as I am aware, is not touched by the ordinary hosiery manufacturers.

Fabrics.

Hosiery fabrics differ from woven fabrics inasmuch as, in weaving, a number of parallel threads (the warp) are interwoven with threads crossing them at right angles (the weft), whereas a hosiery fabric is produced by the interweaving of either a single thread upon itself, or of several parallel threads amongst themselves; the first class forming the framework knitted and hand-knitted fabrics, and the latter class the warp fabrics.

Hand and Framework Knitted Fabrics have a similar formation of loops, hanging in one another at top and bottom, and are extremely elastic in every direction, therefore being best suited for underclothing. Although the loops are the same, there are two different ways in which they are formed on the frames. The original method, as invented by Lee, is by first bending the thread into the form of loops, and then pushing the old loops over them

to maintain the form, and thus produce new loops; bearded or hooked needles (hereafter referred to as bearded needles), sinkers and pressers being used. The other method is by drawing the thread through the old loops, thus producing new ones, as in hand knitting; fixed self-acting latch or tumbler needles (hereafter referred to as latch needles) and movable sinkers, or movable latch needles and fixed sinkers (known as a knocking-over comb) only being used, the latter principle being more general.

Warp Fabrics have a different formation of loops, which hang in one another at the sides, and are formed from a number of parallel threads (the warp) which are carried under and over the needles, the thread being first looped on one needle and then on the next, or, in some cases, on one several needle-spaces away, thus varying the design. Both bearded and latch needles are used. These fabrics are not so elastic as knitted ones, and do not unrove so easily, nor in the same manner.

Warp Looms are used for making fancy fabric in the piece, such as shawls, braidings, strappings, trimmings, and also lengths of material for fancy waistcoats and other garments; not for making fashioned fabric.

The Ordinary Knitting Frames are used for making both fancy and plain goods, but chiefly for making knitted underwear, from socks to combinations. They may make the web in one piece, which is afterwards cut up for making various garments, the pieces being sewn together and forming "cut" goods; or, by adding narrowing and widening tackle to some frames, to increase or reduce the number of loops, the several parts of any article can be shaped, and have firm selvages which are afterwards seamed together, "fashioned" or "wrought" goods thus being formed.

As regards the way in which they are made—fashioned goods form the best, and cut goods the lowest, class; and between these two come "seamless" goods, which are made on circular machines, and those which are made partly of seamless and partly of fashioned or cut fabric.

Plain Fabric is that in which each loop is alike and formed from a portion of one thread only: different coloured threads may be used to produce simple designs or colour effects.

Plaited Fabric is that in which every loop is formed of two independent threads, one of which lies behind the other and is not attached to it except by the "bind" of the loops. In this manner the web may be made with a cotton back and a worsted face, or

During the last few years several improvements have been made in connection with the additional fashioning tackle and other machinery used on these frames, to adapt them for intricate work, and the following specialities are worthy of notice:—

Lace hose and sock, and lace underwear frames, with Jacquard card attachment to actuate the transferring points, which pick up and transfer loops, thus producing an openwork pattern which can, if desired, be of different design on each section, the Jacquard cards being punched accordingly.

Similar frames, with drum and lever attachments for working the transferring points, the design on each section being the same.

Seamless bosom frames, for narrowing and widening in the fabric, as well as at the edges, and on which vests with perfectly finished "gores" (really gussets) are produced.

Embroidery frames, for producing embroidery designs on hose and half-hose by means of a Jacquard card attachment at one end.

A frame with latch instead of bearded needles.

The cost of these frames varies, according to the size, the gauge, and the work for which they are intended, from about two hundred to eight or nine hundred pounds; and in order to get a good return on the large outlay for a set of frames many manufacturers work at night during the whole year, and others during the busy seasons; the hours varying, the break generally being of four hours (from midnight to 4 a.m.), but sometimes only of one hour.

Lamb Frames.—In these frames the two needle bars, which stand in the position of an inverted "V" with an opening at the apex, are fixed at the top of the machine, the joint needle bar thus formed having moveable latch needles on each side, and the thread carriers run backwards and forwards over same, from end to end. The frames are of various sizes, from ten inches upwards, the larger ones being worked by power and employed in the manufacture of cardigans, sweaters, and fancy jerseys, and the smaller ones being used for the making of seamless gloves, fancy hose-tops, and the like, by manual power. On some a Jacquard card attachment is used for producing fancy fabric.

Seamless Leg Machine.—An automatic narrowing machine for making seamless legs is in use for producing the best class hose. It is a flat bar knitting machine, with two sets of latch needles, worked from two independent fashioning bars, and, like the Cotton's frame, is divided into sections. Fully fashioned plain seamless hose legs with, in some cases, shaped heels, are made, the footing

afterwards being done on another frame; and seamless sleeves and pant legs can be made on a similar machine.

Circular Machines or Heads.

Under this general heading may be included all circular machines or heads, which, with the exceptions mentioned, have latch needles. The frames are circular and either have fixed thread carriers and, where used, presser bars, and a movable circle of needles; or moveable thread carriers and a fixed circle of needles. In one case the circle of needles, and in the other case the thread carrying frame, revolves continuously on its axis, though on some machines the motion can be made reciprocal when necessary. Fashioned goods cannot be made on them, but on some machines it is possible to give shape to the articles produced by altering the arrangement of the loops.

Fabric Machines.

Loop Wheel Machines.—The loop wheel is one of the oldest types of circular machines, and derives its name from the wheel used in forming the loops, which takes the place of the sinkers on the flat frames. They are extensively used for the production of plain fabric, in a continuous piece or, working from a rib top, in lengths as required, and are entirely automatic, there being no change of needles, which are bearded. In common with the two next mentioned types, they are either fixed separately or in sets on iron frames, and the fabric from many of the small heads is drawn upwards by a weight attached to a string running over a pulley fixed in the floor above, while continuous pieces from the large machines are wound on to rollers. The fabric is used for underwear, and also for the lowest class of hose and half-hose, in which the feet are formed by cutting and stitching; the size of the heads for bodies, legs, arms, and hose varying. A very large loop wheel machine is used for making pearl work fabric.

Circular Plain Fabric Machines.—In addition to the loop wheels, there are a few other bearded-needle heads and many latch-needle machines, of varying sizes, for making continuous lengths of fabric. The rate and quality of production varies according to the number of threads used; and machines of this class with thirty, forty, or more feeders are used for making the cotton fabric with which the carcases of sheep and beasts are covered. Striped, fleecy, openwork, and other fancy fabrics can also be made on some of these machines.

Circular Rib-top and Rib-fabric Machines.—There are several

types of these machines of different diameters, all modern ones having two sets of latch needles. The rib-top machines have apparatus for making a welt and are used for making rib-ends, much as rib-tops for hose, rib-cuffs, and rib-ends for undershirts; and the rib-fabric machines make ribbed fabric, which can be cut up for rib-ends; fancy rib, with openwork pattern in some cases, for cardigans, jerseys, sweaters, etc.; and pearl and other fancy fabric, for children's gaiters, hood trimmings, and the like.

Machines of this class are also used for the manufacture of tam-o' shanters and Swiss underwear, the necessary shape being given to the fabric by an automatic change of rib.

The rib-ends which I have mentioned are either "run on to" the needles of plain hose machines, the plain fabric being worked therefrom, or are attached to such fabric by linking or stitching.

Sock, Half-Hose, and Hose Machines or Heads (Circular).

The aftermentioned heads all have latch needles.

Non-automatic Machines.—At the present time these machines, of which the "Griswolds" are the best known, are most extensively used for the manufacture of half-hose, although they have been superseded to a large extent by the "automatics" for plain work, and to some extent for rib work. They can be employed either for plain work, or, with an additional set of needles, which can easily be attached, for rib work, on which they are generally used. Although these machines require more attention than the "automatics," and the rate of production is lower, they have an advantage, inasmuch as hose can be given some shape by changing the needles and altering the rib, thus closely imitating the properly fashioned goods.

Semi-automatic Machines.—There are many types of machines known as "three-fourths automatics" and "seven-eighths automatics," and they are in general use; although very few are now being sold, as they have been largely superseded by the "full automatics." They are fully automatic except that, in both, attention is required for changing the motion from circular to reciprocating, for forming the heel and toe, and also in the "three-fourths" for again changing to circular motion. These machines are used for making socks, half-hose, and hose, with rib tops, the tops being "run on to" the needles; and they can also be used for making plain hose, though this is more profitably done on the full automatics. Ribbed hose can be made on some of these machines, but the needles have to be changed by hand for altering the rib, &c.

Full Automatic Machines.—These machines, of many types, are similar to those last mentioned, with the exception that they are entirely automatic, the motion being circular for the leg and foot, and reciprocating for the heel and toe. With one exception they are used for plain work, and are usually employed in making a continuous length of hose fabric with shaped heels and toes, which is afterwards cut up, welted at the top, and linked or stitched at the toe. They can be used for working from rib-tops, and they may also have an automatic splicing attachment.

The only machine of this class for rib-work, the "X L," (manufactured by two firms and styled "S/X L" or "X L No. 2") is used for ribbed half-hose, and automatically welts, forms a top of a certain rib, say, "one and one," and a leg of another rib, say, "three and one," changes to reciprocating motion for the heels, which are plain, to circular motion for the feet, which have plain soles, and again to reciprocating motion for the toe, and recommences on circular motion with the welt. It is the only machine in which the needles are automatically changed, and merely requires attention as regards the feed. The fabric produced is cut above the welt, which is cleared; and the toes are finished by linking the opening at the bottom.

Warp Looms. Very few warp looms are used in this country, the majority of the warp fabrics being produced in Germany, but some will be found in a few fancy hosiery factories.

Hand Looms or Frames have bearded needles, sinkers, and pressers. There are now only very few in use, and these will be found in the country frame-shops.

Flat Warp Loom.—This loom, worked by power, is usually about twelve to fifteen feet in length, four feet in width, and four feet and a half in height; has a fixed bearded needle bar and movable sinkers and presser bar at the top, and wooden warp rollers, round which the thread is wound, below.

Upright Warp Looms.—This is an iron-frame power-loom of about the same size as the ordinary rotary frame (about ten to twelve feet in length and six or seven feet in height), with an extension at the top for carrying the wooden warp rollers; and has vertical latch needles on a needle bar which moves up and down, and wire thread guides which move between and around the needles, the bars on which they are fixed moving from side to side, and also backwards and forwards, and being actuated either by Dawson

wheels or by a Jacquard card arrangement. For double rib-work an additional set of needles is used; and for special fancy work points are placed at rear of the thread guides to form loose loops, which are worked into the fabric and lie on the face.

Circular Looms.—Circular looms have been made and are, I believe, used in Germany, but I have no knowledge of any being worked in this country, nor of weft threads being introduced on the ordinary looms, although this can be done.

Making Up. Although there have been several attempts to manufacture a knitting machine which will make a complete article, there is no such machine of practical use, the nearest approach to it being the automatic ribbed half-hose machine (the "X L") already mentioned. It is therefore necessary to make up the articles by attaching the various parts together; and the extent of this making up, and the way in which it is performed, depend upon the class of goods, fashioned and cut goods requiring the most, and seamless goods the least.

Cutting.—I have already mentioned that piece fabrics are cut up to be formed into different garments; and this is generally done by hand, though power presses with shaped knives, and power jigger knives, are sometimes used, the fabric being cut in layers.

Welting.—This is the process of turning-over and fastening the tops of hose and other garments, and although it is sometimes done on the knitting machines, it is generally done on a small sewing machine making an overlock stitch.

Seaming and Linking.—This consists of joining together two pieces of fabric with threads of the same class of yarn as is used in their manufacture, and is sometimes performed by hand, but generally by machinery. Two firm selvages can be attached together, and this is known as seaming; linking being the joining of a firm selvage and a loose end (*i.e.*, either end of a piece of fabric which can be unroved), or two loose ends. The machines for seaming and linking are practically the same, and have a dial or plate with a set of horizontal points on which the loops forming the selvage, or the loops a few rows away from the loose ends, are "run on" (one loop of each piece of fabric on one point), and the dial is then set in motion and brings the loops under the needle, which forms an over-stitch or link-stitch. The loops of a loose end above the seam so formed are removed by simply unroving that piece of the fabric, and this is known as "clearing" and is performed by hand; or the loose end may be removed by knives and

brushes attached to the machine, which is then known as a "Self-clearing Linker" or a "Linker and Clearer." As the two pieces of fabric only meet, and do not overlap, the seam is flat, and the stitches resemble knitting loops, and are elastic. Yarns pulled from the fabric in clearing are known as "rovings."

Sewing.—Where articles are to be formed from cut fabric, it is necessary to sew or stitch them together with an ordinary over-lock stitch; and the operation is performed on a sewing machine, using cotton, and having a knife for cutting away the raw edges.

Sewing is also necessary with both high and low classes of underwear, as, after being dressed, the shirts are cut open and "bitted," *i.e.*, pieces of flannel, twill, or other material are sewn on, so that button-holes may be formed and buttons attached; and the pants are "banded" in the same manner, and for a similar purpose. The machines for this work are of the ordinary type, with one to four needles, according to the rows of stitches required.

The sewing machines are fixed on a frame or bench, and driven by banding from shafting carried below, the speed of each machine varying according to the gearing, most forming a thousand to three thousand stitches a minute, and some of the single needle machines four thousand.

Where fancy hosiery is made up, lace and Swiss embroidery may be used, and sewing will also be done by hand.

Mending.—Before the goods are sent to be dressed, and also upon their return, they are examined, and any loose loops secured.

Cleaning.—Occasionally a little benzine is used for removing any oil stains from finished fabrics, though the use of non-inflammable mixtures for this purpose is more common.

Ironing.—Goods which have been mended, or made up after dressing, are ironed. The irons are often heated over gas stoves, and very occasionally on fuel stoves; and I have also seen them heated on a large fire-heated cockle in a fireproof building communicating with the ironing room by an iron door. Gas-heated irons, *i.e.*, irons heated by internal jets, are in general use, and electric irons are also used.

Folding and Tieing-up.—After being examined, or mended and ironed, the goods are folded and made up in paper, ready to be taken to the stock-room or despatched, and those which have been

placed in the stock-room are repacked before being sent out if the papers in which they have been wrapped are greasy or dirty.

Waste Sorting and Storage.—In addition to the ordinary greasy waste and floor sweepings, which are generally burnt (though I have known them to be kept for sale), there are rovings and cuttings and clippings, which have a value in proportion to the cost of the yarn used, sometimes exceeding a shilling a pound. This waste, known as clean waste, is sorted into different classes and then placed in bags or bins ready for disposal to the waste merchant. In some cases it is sorted and stored in a detached building, but more often it is kept in the main risk, generally for several weeks.

Occasional Features.

In some hosiery factories dressing or finishing (including scouring, dyeing, stoving, &c.) is done, in the majority of cases the buildings for this purpose being separate; and in other factories part only of the dressing, such as pressing and brushing, is done. This branch of the trade is really a separate one, but a paper on hosiery factories could hardly be considered as complete without reference to it, and at your request I am dealing with it, and shall treat it as a separate section.

I may here say, however, that where any of the processes are carried on in the factory all precautions should be taken; the possibilities of a fire spreading being far greater than in separate dressing works, where fires may originate and be easily extinguished, as the buildings are generally subdivided and of different construction, and the quantity of inflammable material is much smaller.

There are also several features only met with in some factories, and I shall now refer to them.

Printing.—One or more small platen machines are sometimes used for printing labels, and they will generally be found in the warehouse. Paraffin and paraffin mixtures are usually kept for cleaning, but benzine is sometimes used.

Making-up.—Ladies' blouses and underclothing are sometimes made-up, and in a few cases children's suits and men's flannel garments are manufactured. Power sewing machines and, occasionally, power knives are used, and my previous remarks under "Ironing" apply. Lace and Swiss embroidery will often be used.

Metal Working.—Simple repairs are usually done on the

premises, and in the larger factories there are generally a few metal-working machines and a brazing hearth.

Cardboard Box Making.—This is only done by a few manufacturers, usually in a separate building. The machinery may consist of power guillotines and small circular saws for cardboard cutting, and the glue is generally heated by steam or in gas-heated water-jacketed pots.

Case-making and Repairing.—A little case-repairing is generally done by the mechanic, but the woodworking in connection therewith will only consist of cutting out a new board, and the like. Case-making is very rarely done, and I have only come across it in separate buildings.

Case Soldering.—For export trade metal-lined cases are sometimes used; and the soldering may be done in the main risk by an employee, and a gas stove for heating irons be fixed; or a tinsmith, who will often bring his own stove, may be employed when necessary.

Drying.—Occasionally fabric which has been heavily lathered in manufacture is dried before being made-up; but I have only seen it hung up in rooms containing ordinary steam or hot water pipes, and have not come across any special drying-rooms or stoves.

Definition of a Factory.

For insurance purposes a factory is regarded as a building in which knitting is done by power, but as a rule most of the other operations mentioned are also performed therein.

Definition of a Warehouse.

The warehouses may be divided into three classes—those of the manufacturer situate on the same premises as the factory, those of the manufacturer which are away from the factory, and those of the factors.

The first class may either communicate with the factory direct, by fireproof compartments, or by gangways, or be detached, and will generally be used for the storage of yarn, rough stock, and finished stock. Some work, such as winding, welting, seaming, linking, cutting, sewing, mending, ironing, folding, tieing-up, and making-up of other garments may be, and often is, done therein.

In the second class, yarn or rough goods will seldom be stored, winding will not be done, and the other processes will only rarely be met with.

The third class are generally warehouses pure and simple, but

yarn may be stocked to be given out to bag hosiers, and the making-up of other garments may be done.

In all warehouses finished goods are stocked in wood racking running from floor to ceiling, and yarns are occasionally so stocked, but are generally kept in skips or cases.

General Features.

Buildings.—Almost without exception the buildings are substantially constructed of bricks or masonry, and are roofed with tiles or slates and glass. The warehouses are usually of two to six storeys in height, with a basement, and only occasionally of one storey; and the factories are of basement and two to basement and five storeys in height; or of one storey, generally with a north-light slated and glazed roof, and sometimes with a yarn and stock cellar under. Speaking generally, the one-storey buildings are of good design and construction, although there are a few "jerry-built" sheds. Fireproof buildings are rather uncommon.

Openings.—Internal hoists and staircases of both timber and brick construction are common.

Linings and Partitions.—Timber linings to both walls and floors are general in warehouses, but not in the factories, some of which, however, have a small amount of timber lining to the floors. Timber and glass partitions for offices are common, but otherwise timber partitions are not used to any extent.

Heating.—Generally by low-pressure hot water or steam, the steam pipes being usually carried overhead. Gas stoves and ordinary fires are occasionally used in offices, and pipe stoves are sometimes used in a few small country risks.

Lighting.—Usually gas, often with incandescent mantles, or by electric light, with incandescent or Nernst lamps. Paraffin lamps are used in some country factories, both large and small.

Power.—Steam and gas engines are in general use, and often placed in the main building, but the steam boilers are usually in a separate building or in a fireproof compartment. Electro motors are in use in some factories and many warehouses, and the number will undoubtedly increase. Oil engines are occasionally found in the country.

Shafting.—For the finishing and non-automatic hose machines the shafting is carried near the floor, but otherwise it is overhead. Occasionally upright main driving shafts are used, but banding from floor to floor is more common. Rope races are only found in a few large factories.

Lubricating.—The lubricating oils which are used on the machines are all stainless, such as neatsfoot, olive, lard, and stainless mineral oil; and the oils used for ordinary lubricating are of the usual type, but the very cheap lubricants are rarely used. Large drip tins are hung under the shafting bearings; but the oil from the machines falls on to the floors and saturates them to some extent.

Tenure.—As a rule risks are in single tenure, but there are some plural tenure factories, chiefly in Nottingham.

Country Risks.—Owing to the cheapness of labour and land, the absence of trade-union regulations, and the low rates, several of the larger manufacturers have town and country factories, the latter generally being of one storey in height; and a few others have gone into the country entirely, and established large factories at a distance from the towns. There are also some small factories, usually of more than one storey in height, occupied by the old country manufacturers.

Hands.—Most of the hands are of the fair sex, men usually only being employed in warehousing, attending to the machinery repairing, and working the fashioned work frames.

Appliances.—Usually buckets, and often pumps and extincteurs as well, are installed, in many cases only as a means of reducing the premium, and not for their value as extinguishing appliances.

Fire Hazard, Factories and Warehouses.

I have not had an opportunity of obtaining any reliable statistics, but from the information I have received it appears that the majority of fires broke out in the night, the cause being unknown, that a few were put down to spontaneous combustion, and that others were traced to simple accidents, such as gas lights coming in contact with goods, etc. I shall therefore have to depend chiefly upon my own observations in dealing with the fire hazard, and the first point for consideration will be the nature of the materials used and the goods manufactured and stocked.

The raw materials consist of yarns, which do not undergo any chemical treatment, but are only formed into a fabric which is, in some cases, made up with other materials, such as woven goods of wool, cotton, and silk. The yarns generally used may be divided into four main classes—those composed of (*a*) wool, (*b*) cotton, (*c*) wool and cotton, and (*d*) silk—and it will be appreciated that the risks must consequently vary to a great extent, and, other things

being equal, the best risk would be that where wool yarns only are worked, and the hazard would increase with the percentage of cotton used. The silk hosiery factories would rank next to those where wool only is used, and the risk would increase in the same manner. There are, however, certain shoddy yarns which I have mentioned, and the extent to which they affect the risk is uncertain; but I understand that such yarns have been known to fire spontaneously, and some manufacturers will not keep their stock in the factory but only bring in a small quantity as required. Possibly some of the "imitation" yarns are not hazardous, as they may contain only a very small percentage of oil; but, in my opinion, the storage in the main risk of any unscoured woollen yarns, or any cotton yarns which have been spun with oil, is very undesirable.

The machinery, with the exception of the sewing machines and the rarely used doubling machines, is all of slow motion type, and there does not appear to be any danger of friction, as the sewing machines are only in use for a few seconds at a time and the rapidly-moving portions are of light construction, the work on them not being heavy. The shafting is of the usual type; and wood boxing round the gearing of upright main driving shafts, where used, would appear to be the only objectionable feature. There is, however, a considerable quantity of "fly" or "fluff" produced, especially from the winding machines, when cotton and loose cotton mixtures are being worked, and also in the manipulation of some of the woollen yarns; and the cotton fluff rising from high-speed winding machines has been known to ignite from gas jets. It is, therefore, well to see that there are no gas lights within three or four feet of any winding machine. This "fly" settles on the steam pipes and shafting and in the drip tins under the bearings, and I have often seen considerable accumulations, as in some factories it is the practice to thoroughly clean up once or twice a year only. Where it is allowed to accumulate on steam pipes there is a possibility of its igniting; or, carbonizing, falling and igniting; and if it is allowed to accumulate in the drip tins and become saturated with oil, there would appear to be a chance of spontaneous combustion. The "fly" also accumulates on the strings which are used for drawing off the work from some small circular heads, and these would assist in the progress of a fire.

The disposal of the waste is an important feature, and while the dirty floor waste is generally, though not always, removed

from the buildings daily, the rovings and clippings are often placed in bags or bins and kept for weeks or months. Where a clean yarn is used and care is taken that no waste which has become greasy by contact with machinery is stored, there is no hazard, but I have often found yarn with a considerable quantity of grease on it put away as "clean" waste; and the waste from the unscoured oily yarns previously mentioned is sometimes stored. The storage of all waste, no matter what yarn be used, in separate and distinct buildings is much to be desired.

In connection with the welting, seaming, linking, and sewing, special attention should be given to the lighting arrangements, as moveable gas brackets are often used, and in some cases they are so badly arranged that there is a possibility of the lights coming in contact with the articles which are placed on the benches.

The arrangements for ironing deserve some attention. The gas stoves or iron boxes should always have fixed metal tubing, and stand on a raised iron tray or table, or on a stone slab; and if they are of any size, or of the same type as those used by clothing manufacturers, the tray or table should have iron supports twelve to eighteen inches in height, or the slab should be at least two inches thick, and there should be an air space of several inches between it and the stove or between it and the floor. Sometimes a stove is fixed with a small air space between it and the tray or slab and also between the tray or slab and the wooden floor or bench. Theoretically this is a good arrangement, as considerable heating of the stand would not affect the floor or bench, but in practice it is found that waste often accumulates in the lower air space unnoticed, and it may come in contact with the stand and be ignited through slight heating. It is therefore necessary to have a space of at least six inches between any stand and a wooden base.

I may say that in one case which recently came under my notice a two-iron box stove was fixed on a two-inch stone slab, with a half-inch air space, and the heat fired the floor on which the slab rested.

Gas-heated irons generally have a rubber supply pipe, and it is extremely difficult to induce manufacturers to substitute wired and cotton-covered or flexible metal tubing, as they raise the objection that such tubing is not flexible enough and makes the irons too heavy in use; but I recently saw a manufacturer who has used flexible metal tubing for two or three years, and both

he and the operatives were perfectly satisfied with it. The tubing varies considerably in flexibility, and possibly the kind best suited for the purpose is not always obtained. The best method of lighting the jets in the irons is to have small jets constantly burning, and the use of matches should be discouraged. If electric irons are used, attention should be paid to the flexible wires, as there should be some arrangement to prevent them being cut or damaged, either on the irons or at the roses; and there should be two single pole fuses to each iron. It is important that proper stands should be fixed for all irons.

The hazard, other than that from defective arrangements, depends upon the nature of the fabric ironed, and is greatest with cotton-backed fleecy hosiery, and decreases to a vanishing point with wool goods, whether brushed or not. With brushed goods the nature of the fleece, *i.e.*, the material of which it is composed and the thickness, must be taken into account, but the manner in which the fleece has been raised has absolutely no bearing upon the risk.

Steam-heated ironing machines are very rarely used, even in dressing works, and it is doubtful whether there is any danger from them, whatever amount of cotton a fabric may contain.

Where printing is done a proper metal waste receptacle should always be supplied, and precautions should be taken with regard to the use of benzine for cleaning the rolls, as also with that used for removing stains from fabrics. Not more than half a pint should be brought into the main risk, and its use by gas light should be prohibited.

In metal working, cardboard box making, and case-repairing, the arrangements for the removal of greasy and dirty waste and shavings, and those in connection with the heating of the glue, call for notice; and if case-making is done, the arrangements in connection with the power wood-working will require specia attention. An objectionable practice, commonly met with, is that of heating glue over an ordinary gas jet, with the result that carbon is deposited on the glue pot, owing to the imperfect combustion of the gas, and falls off in a red-hot state. Where case soldering is done there should be a properly fixed stove for heating the irons, and no other should be allowed. A metal-covered bench on which irons may be placed is also desirable.

I need not call attention to the many risks from imperfect lighting and heating arrangements, except to the practice of

placing pipe stoves and large gas stoves in an iron tray only, and not on a stone slab.

The engine-house is often badly lighted, and a little extra care may well be taken here, as an accumulation of greasy waste, sometimes in the mechanic's cupboard, or a defective exhaust pipe, may be discovered. Sawdust is sometimes placed under engine bearings and also under motors and oil barrels to soak up oil drippings, and this should not be allowed, as there is a possibility of spontaneous combustion.

Electro motors are often placed on wall stands near the ceiling, and sometimes on frames suspended from the floor above, but this is rather objectionable. They should be of the enclosed type, or placed in separate compartments, not only in factories, as required by tariff, but in any room where there is any "fly" from winding, brushing, etc.

I have mentioned that Cotton's frames are worked at night; and it may be considered that this is an addition to the risk, but it must be remembered that there is no danger from the machinery, and that there are fewer hours in which a fire can obtain a hold before being discovered.

The tendency on the part of the larger manufacturers to erect factories in the country has been mentioned; and I may say that these risks are generally good ones, though they are likely to deteriorate, as they are rarely reinspected. The movement in this direction is not altogether to the advantage of the Insurance Offices, as the villages chosen are generally at a considerable distance from a good brigade, the water supply is often poor, and usually the minimum rates only are obtained, as the buildings are chiefly of shed construction. I may here mention that coal-fuel steam-driven motor waggons are being used for cartage, and it is necessary to see where they are kept, and whether they are allowed to enter a loading gateway, and if so, what precautions are taken. Possibly petrol motors may eventually be used, and this will increase the additional hazard introduced through the growing popularity of motor cars and bicycles, which are sometimes brought into gateways and other portions of the main buildings. Enquiries on this point, and also as to the storage of petrol and acetylene, are now necessary when dealing with these and all other risks.

The small factories occupied by the old country manufacturers, to which I have referred, are not, as a rule, very desirable risks.

HOSIERY DRESSING WORKS.

Some manufacturers do their own dressing or part of it, as already mentioned; but as a rule the goods are sent direct from the factory to the dressing works, where they undergo the various processes, and are returned ready for making up.

Examining, Etc. When the goods are received at the dressing works they are first marked with various threads, the operation, in common with that of attaching several articles together, being known as "tacking." They are also turned, sorted, and, where necessary, tacked together. One or more rooms are generally set apart for this work, and also for mending any goods which have been damaged.

Water Softening. As it is essential that the water used should be soft and free from all impurities, it is generally necessary to soften it by chemical action, and this is done in various ways, the agents used being lime, caustic soda, carbonate of ammonia, etc. The water-softening apparatus and tanks are often placed on top of a building, and, owing to the great weight, generally supported by extra brick piers or iron columns and girder work.

Scouring. The first process is that of scouring, which consists of thoroughly washing the goods in a warm water solution of soap and alkali. The scouring machine in most general use consists of a slowly-revolving tub, or a square vat having a backward and forward motion, in which large wooden beaters or dollies rise and fall alternately. These machines are generally known as scouring machines, but the tubs are sometimes referred to as "dollies" and the vats as "tom-toms." There is also the hydraulic washer, which consists of a large closed cylinder (with water, steam, and waste pipes) in which the goods and the liquor are placed, and which is then set in motion, the rotation being constantly reversed. When long lengths of fabric are being dealt with they are often washed in an open scouring tank and passed between rollers to squeeze out the dirty suds.

Milling or Fulling. The object of milling, or fulling, is to felt the goods to a certain extent, the wool fibres of which they are composed tending to shorten in length and to curl and intertwine, thus slightly shrinking, but strengthening and thickening, the fabric. The milling, or

fulling, is done by pressing the moistened goods in the fulling mill (often known as a "Scotch mill" or "Scotch fuller"), which consists of a zinc-lined trough in which two heavy wooden beaters move backwards and forwards alternately; the goods being treated with soap lye and placed in the trough in front of the beaters.

Bleaching and Stoving. After the goods have been scoured, or scoured and milled, they are rinsed, and are then ready for bleaching and dyeing, or either process; the best dyed goods being generally first bleached. The natural colour of cotton and wool is not pure white, and if it is desired that the colour of a white fabric, or the white yarn used in a mixed fabric, should be pure, bleaching is necessary.

Cotton goods are usually bleached, or "chemiced," by treating them with chlorine, which has the property of destroying those substances which give the cotton a tinge, leaving pure cellulose only. The general method is to place them in a bath of chloride of lime, so that they take up some of that salt, then dip them in a bath of dilute sulphuric acid, which, by chemical action, sets the chlorine free to destroy the colouring matter, rinse in water, boil in an alkaline solution, and finally pass them through a bath of very weak acid solution. Another method, which is very simple but not so satisfactory, is to steep them in a bath of water, chlorate of potash, and muriatic acid, and afterwards wash them in borax water.

Wool goods are usually bleached by treating them with sulphurous acid, generally in its gaseous state, but occasionally in a water solution. In the first case the goods are hung in a wet state on poles in an airtight chamber, known as a brimstone or sulphur stove, which is nearly always constructed of timber or timber-lined brickwork. Unlined stoves of brick and mortar construction are unsuitable, owing to the chemical affinity between the sulphurous acid and the lime of the mortar; but blue bricks, or glazed bricks or tiles, with plaster of paris cement, can be used and are preferable from our point of view. The sulphurous acid is obtained by burning sulphur or brimstone in iron or earthenware vessels in the closed stove. In the second case the articles are immersed in a water solution of sulphurous acid, prepared by burning sulphur in an iron retort or stove and forcing the vapour through the water by means of a blower.

Wool and silk goods may also be bleached by steeping them in

a solution of sodium peroxide, or of peroxide of hydrogen and alkali, and then rinsing them, first in dilute sulphuric acid and afterwards in water.

Dyeing. Where self-dyeing colours are used the goods are only dipped in a colour solution; but many colours are not self-dyeing, and it is then necessary to use a mordant, *i.e.*, some salt which mixes with the colouring matter and forms an insoluble compound which is precipitated in the fibre, the most common being salts of aluminium, copper, tin, iron, and chromium. The dyes used are of the animal class, such as cochineal; the vegetable class, such as indigo, logwood, barwood, camwood, madder, and fustic extracts; the mineral class, such as sulphate of iron (copperas), nitrate of iron, and bichromate of potash; or the coal tar derivates, such as anilines, diamines, and naphthols—the latter class being now most generally used. A process of oxidation is also necessary with some colours, such as indigo and aniline blacks and blues, the insoluble oxides so formed constituting the colouring matter; and after coming from the dye vats articles are often immersed in a solution of chlorate of potash or similar salt to hasten this process.

The goods are placed in vats of cold or warm solution, steam heat being used, and are constantly stirred up with poles. Power-driven wooden frames of various types are also used to keep the articles in motion. Gas or steam-heated dye pots for mixing dye stuffs are generally found in the dye-house.

Drying. It is sometimes necessary to dry the goods to a certain extent between the various wet processes, and this is usually done in a centrifugal machine, which is also used before the goods are finally dried. This machine, generally known as a hydro-extractor, consists of a circular iron pan with an inner cage of galvanized iron or copper, either perforated or in the form of wire, which revolves at a high rate of speed and thus expels excessive moisture by centrifugal force. It may be driven by banding or by a small steam cylinder forming part of the machine.

If the goods have undergone all the necessary wet processes they are dried in open-fronted buildings (known as poling sheds), in heated rooms or chambers (known as drying stoves), or in drying machines.

The drying stoves are of one or two storeys in height, and are heated in various ways, as aftermentioned.

Cockle Stoves.—These stoves are heated by cockles, which are fuel stoves with iron flues one or two feet square running round the floors, which are of concrete or brickwork, or under iron gratings in the floors. These cockles either have the stove and firing hole inside the building or are fed from the outside, and the stoves proper, and the flues near, often get red hot. Where they are used on the ground floor of a two-storey building the floor above is often constructed of perforated iron, and occasionally of open woodwork; and the upper storey is then used as a drying stove, in some cases steam radiators also being fixed. They are sometimes, though very rarely, placed on an upper floor of concrete, or plaster-covered woodwork. This system of drying has to a large extent been superseded.

Boiler Stoves.—A compartment over the boilers is often used for drying, the floor being of perforated iron; and steam pipes are in some cases also placed therein.

Boiler-flue Stoves.—The heat arising from these flues is sometimes utilised for drying. They are carried under the stove floor, which is constructed of firebrick and concrete.

Steam Stoves.—Many stoves are heated by steam, the pipes either being carried under iron floor gratings, or around the sides. There are also stoves heated by air which is forced through steam coils in a separate compartment.

In all stoves, metal, and, in some cases, wood fittings, are attached to the walls or ceilings, so that poles, or the boards aftermentioned, can be suspended therefrom; and in many cases they have false timber ceilings and timber roof ventilation shafts, and the doorways are fitted with iron doors, generally of poor construction.

At one time nearly all goods were stretched on wooden or tinned iron shapes for the stove-drying process, the operation being known as "boarding"; but quite recently some dressers have given this up, except for goods which obtain their shape in the finishing processes, such as tam-o'-shanters and low classes of underclothing. The goods which are boarded are hung from the racks, which have notches or clips for holding the shapes, and the other goods are placed on poles which are slipped over the racks, or are spread on a fixed rack of wooden laths.

The use of drying machines is not yet general, but they are certain to be extensively used eventually, as they possess many

advantages. Those now being used are Petrie's and Wever's, or of similar type.

Petrie's drying machine consists of a chamber of timber construction, with a continuous chain-worked "brattice" of iron bars running from end to end, on which the goods are placed, carried through, and dropped off into a receiving basket. At the side of this drying chamber is a smaller one, in which rows of steam pipes are fixed, and fans are arranged to draw the air over these coils and into and through the drying chamber. These machines are used for drying socks, half-hose, and hose.

Wever's machine is only intended for drying lengths of tubular fabric. It consists of an iron chest containing steam coils, through which air is drawn by fans and forced through perforations in a large metal tube, around the bottom of which is a metal receiving box. Above the tube is a hollow steam-heated jacket, and above this again power winding-up rolls. The circular fabric is dropped over the perforated tube into the receiving box, and one end is brought through the jacket and fixed on the roller. The hot air is sent through the fabric, which is gradually drawn up, thus blowing it out and bringing it into contact with the steam jacket, which also assists in the drying.

Tentering. Only high-class lengths of woven or closely knitted fabric are tentered. They are stretched on a large wooden frame, known as a tenter, which has hooks on which the fabric is caught. Steam pipes may sometimes be used to heat the room, but the fabric has previously been dried to a certain extent, and it is better to complete the drying gradually. This process must not be confused with stentering.

Singeing or Gassing, and Turning. Some classes of woollen and wool union gloves are often singed on the face to remove short fibres, and the operation is performed by passing them through gas jets by hand, the gloves afterwards being turned if the inside is to be brushed.

Brushing. After being dried the goods may be brushed by a power machine, usually to a slight extent only, so that the ends of the fibres are raised, thus giving the goods a full soft feel. In some cases the goods are heavily brushed, the object being to brush out special fibres to make fleecy hosiery, or to brush up the ordinary fibres to such an extent that they hide the loops. The brushing machine consists

of two rollers, either covered with teazles or wire cards, revolving in the same direction, and in front of which are two feeding rollers which are driven slower so as to give the required drag. Feeding and receiving boards are fixed, but the machine is not enclosed, and as the goods are passed through the fluff flies from the rollers and settles about the room. Tam-o'-shanters are finished, after being well brushed, by placing them on boards, which are then attached to revolving spindles, and wire brushes are applied by hand. This might be termed "spindle brushing," to distinguish it from ordinary machine brushing, and also from hand brushing, which is done with a wire brush, the object in both spindle and hand brushing being the same, *i.e.*, to straighten out the fleece and carry it in one direction.

A large brushing or "napping" machine, which is common on the Continent and in America, is now being introduced for brushing lengths of fabric. The brushing is done by a number of wire-card covered rollers (usually 24) and two drums with wire brushes, arranged on the planetary system, and the fluff is collected in a metal receptacle under the machine, which much resembles a carding machine in appearance.

Pressing or Trimming.

The usual method of pressing or trimming goods is to first slightly damp them, pull them on to wooden shapes, and place them in a steam-heated compo-covered metal press, which is then screwed down, generally by hand, but occasionally by power. They are left in the press for a minute or two and then pulled out and taken off the shapes; in some cases underclothing being afterwards placed between smooth millboards, which are put into another press in layers. At one time many presses were heated by gas, and in others the heat was supplied from iron plates heated in brick-built fire ovens, but such presses are now only used for special work, and that occasionally. The presses, more particularly the latter class, are often referred to as trim stoves, and the term "trim shop" is generally applied to the pressing-room. Some goods are only pressed between smooth dry millboards which are placed in a hydraulic press, piece fabrics being pressed in this manner.

Ironing.

Ironing is usually done in finishing works in the same manner as in the factories and warehouses. Occasionally steam ironing is also done by passing fabrics over a roller revolving against a concave steam-heated body.

Conditioning. After pressing, it is desirable to restore the natural moisture to wool and wool union goods, and this is done by placing them in a room with a perforated floor over water troughs, or by steaming them in some manner.

Special Processes. There are two or three special processes where the dressers are not willing to disclose the nature of the agents used; such as the "unshrinkable" process, where goods are immersed in a solution to prevent shrinkage in wear and washing; but the chemicals employed are stated to be non-hazardous.

Treatment of Various Goods. No rule can be given as to the treatment of any class of goods, but, speaking generally, cotton goods are only pressed, the best white ones being bleached; and low merinos, which are chiefly composed of cotton, are pressed, or brushed and pressed, and the white ones are also bleached. Lamb's-wools, worsteds, cashmeres, and merinos may go through all processes, with the exception that worsteds and cashmeres are rarely milled. Any of these goods can be dyed, but in different methods, and the sulphur stoving of part-coloured goods is rare.

Storage. As a rule there are separate stores for the different groups of materials used, such as logwood and other wood dyes; soap, alkali, oils, and acids; and dyes and dry salts of all descriptions; and these stores generally communicate with the main block. In some cases the colour store may also be used as a laboratory, and gas stoves and Bunsen burners be used.

General Features. *Buildings.*—Wet processes are nearly always carried on in buildings of one floor, but occasionally in the lowest floor of a storied building. The other buildings are generally of one or two storeys in height, but sometimes there are as many as four or five floors. Many of the buildings are very old and in poor repair, but this feature is not of great importance in wet sheds, where louvre board ventilators in roofs are also general. Fireproofing is confined to stoves.

Openings.—Internal timber stairs and hoists are common.

Linings and Partitions.—Ceilings in storied buildings are sometimes lined, but partitions of wood are not common.

Heating.—Practically always by steam, which is also used for many processes. Pipe stoves may be found in old premises.

Lighting.—Gas is the general illuminant, but incandescent electric light is used in two or three risks.

Power.—Steam is almost universally used, but gas engines are in use. Engines are often fixed in different parts of the works, and small unenclosed engines are sometimes used. The boilers are often in, or communicating with, the main risk, and may have drying stoves over.

Shafting.—In the brushing and sewing rooms the shafting is of the usual type, but in the wet sheds or floors it is of the heavy and slow motion type. In dressing works little power is required for the machines on the upper floors, and belting is used to connect the shafting.

Drying Stoves.—The drying-rooms are rarely of fireproof construction entirely, and often communicate with the main block, sometimes by iron doors, as already stated.

Brimstone Stoves.—In some cases these stoves form part of the ground floor of a storied building, but they are usually separate buildings of timber construction.

Dry Cleaning.—Some hosiery dressers are also garment cleaners and dyers, and may adopt the dry process, in which benzine is largely used; but the trade is a separate one, and practically always confined to a distinct block of buildings.

Soap-making.—This is occasionally done in separate buildings, the soap being mixed in steam-heated vats.

Yarn Dyeing, &c.—In many dressing works yarns are dealt with and go through some of the processes mentioned. Cotton yarns may also be mercerised by being passed through a solution of a non-hazardous nature.

Situation.—Nearly all dressing works of any importance, with the exception of those attached to country factories, are in, or near, towns of some size, where there are good fire extinguishing appliances, and the nature of the business necessitates the selection of a site with a good water supply.

Fire Hazard in Dressing Works.

The simplest way of dealing with this subject will be to touch upon the process and features in the order of description.

There is, of course, no risk in examining, tacking, and mending, but the arrangement of the steam pipes in the rooms requires special attention, as they are often carried near the floor, waste accumulates on them, and the hands place all classes of rubbish behind them.

The point requiring attention with regard to the water-softening arrangements is the construction of the building over which any tank is placed, and the nature of the materials therein, as owing to the weight of a large tank, a small fire may affect any iron supports sufficiently to cause a collapse.

In the scouring, milling, bleaching, and dyeing, and also in the conditioning and "unshrinkable" processes, there is no risk, except from the use of the chemicals aftermentioned.

With brimstone stoves it is important to see that the vessels in which the sulphur is burnt are of sufficient depth to prevent the burning sulphur from overflowing and catching the woodwork, or that such an accident may not be caused through the vessels corroding or not being properly cleaned out after use, and where a retort is used the fixing will require attention.

When we come to the drying, there are many risks which are obvious, and, although it practically amounts to having a free Turkish bath, the surveyor must see that cockle stoves and flues and boiler flues are sound and, together with the steam pipes, not near any woodwork; and where there are iron gratings, that "fluff" has not been allowed to accumulate on the steam pipes or boiler tops, and ascertain how often such "fluff" is removed from all drying-rooms. He must also see that the racks are secure, and where cockle stoves are used, that the hanging of the goods is so arranged that it would be impossible for them to fall on to the stove or flue. Flues of cockle stoves, and those from boilers, both suffer from wear and tear, the former through the iron oxidizing, and the latter, unless stoutly constructed of the best fire bricks and clay, through the cement crumbling, and must therefore be examined, and, if necessary, repaired and strengthened, as sparks might come through any cracks and catch the articles which are being dried. The risk from these stoves varies to a great extent, and is added to by the use of wooden racks and fittings and timber ceilings and ventilation shafts.

I have mentioned a process of oxidation in connection with dyeing; and if the chemical action is not completed before the goods are placed in the stoves, the heat will tend to hasten it to such an extent that the goods may be damaged and, possibly, spontaneously fired. This might occur in a stove of the best construction, and in which steam-heated air only is used, and emphasises the desirability of all stoves being fireproof. This is not an imaginary danger, as I have seen goods which have been

spoilt in this manner, the fabric becoming harsh and dry and losing its "nature"; and there have been several mysterious fires in drying stoves.

Where drying machines are used it is necessary to see that the steam pipes are clear of woodwork and also have proper guards, fluff often accumulating in any space between a pipe and the woodwork, and the use of asbestos packing or cemented sanitary pipes is to be recommended. In Wever's machine a portion of the hot air trunk and the fan are usually placed in a compartment under the floor, and attention should be given to the manner in which this is done, and the arrangements for lubricating.

In the tentering rooms the lighting requires special attention, and no gas brackets capable of swinging on to or near the frames should be allowed.

The singeing or gassing should be done in a separate room, and the benches might, with advantage, be metal covered.

The brushing may sometimes be attended with great hazard, or the risk from it may be practically *nil*. Where woollen goods only are brushed there is no special hazard, as the pure wool "fluff" or "fly" will not fire by merely applying a light; but where wool and cotton mixtures are brushed there is a risk from the highly inflammable cotton "fly," and the extent of this risk depends upon the percentage of cotton used, being slight with a small percentage, and greatest where cotton-backed fleecy hosiery is brushed. The "fluff" or "fly" comes away from the machine in a cloud, and if such a cloud containing a large percentage of cotton comes in contact with a gas light, there is a flash which may be communicated to any material near. The use of gas lights in brushing rooms is objectionable, and if it is necessary to have them, they should be five or six feet away from the brushing rollers and in front, or immediately above, but not behind, them. As scoured goods only are brushed the fluff is not liable to spontaneously ignite, even if allowed to accumulate; but there is a risk if it accumulates on steam pipes and gearing, and I have already called attention to this feature in the first section of this paper. As mentioned, both teazles and wire cards are used in brushing, and, other things being equal, there is possibly more hazard with a card brushing machine, but the difference is very slight. Theoretically there is an increased risk, as any excessive heat in the bearings might be communicated to the cards and thus cause a fire, or some grit or other foreign substance might be con-

tained in the fabric and come in contact with the cards and produce a spark. There is, however, little probability of overheating on the ordinary rollers, as they are not run at great speed or under heavy pressure, and the possibility of scoured goods containing any hard foreign substance is equally slight. The idea that cards are used to raise the thickest fleece, generally entertained in Insurance circles, is entirely erroneous.

In pressing shops the point to be noticed is the arrangement of the steam supply pipes, and if they pass through any woodwork they can only be regarded as satisfactory if they have metal or earthenware collars of some description, as, owing to the constant jar from the presses, they are liable to move and come in contact with woodwork, even if there were originally large air spaces.

I have referred to the precautions necessary in the sewing and ironing departments in my remarks on the fire hazard in factories and warehouses.

The storage of the various agents requires some attention. Logwood, camwood, etc., are purchased in the form of small chips, and although they are often slightly damp, there would not appear to be any danger of serious overheating. The other dyes are generally in the form of a powder, and are stored in barrels and boxes in a dry building. The chlorates, nitrates, and carbon dioxide should be kept distinct in a dry place and well away from phosphorus and sulphur; the peroxides ought to be kept in a separate cool compartment; and the acids should never be stored in a room in which any other chemical is kept or where, in the event of a breakage, they could flow and come in contact with any inflammable material. New chemicals, or new uses for well-known chemicals, are constantly being introduced, and careful investigation in the stores may lead to some discovery of importance.

Where dry cleaning is done special attention should be given to the construction of the buildings devoted to that process and to the storage of benzine, and the distance thereof from the dyeing works proper, and also to the slope of the ground. If a large quantity of benzine is stored in any building near to the main risk, and not on a lower level, some form of trench, or other barrier, to prevent the flow of the burning spirit in the event of an accident, may be desirable.

If soap is made, the boiling vats should be in a separate building, and the grease and oil stores should also be separate.

The lighting and heating will require ordinary attention, but

where there is an electric installation a special examination of all cabling is necessary. In rooms where there is any dampness, either from wet or steam processes, wood casing should never be used, but the cables should be carried in special moisture-proof tubing, and the flexibles should also have a special watertight wrapping. Wiring in stoves should also be enclosed in metal tubes, or be specially armoured with lead or other metal, and be free from joints. Twin flexibles should not be used in damp rooms or stoves. Damp-proof lamp fittings only should be used where there is any moisture, as in dye houses, etc., and lamps should not be removed from the holders, otherwise than temporarily, in such places, or in any room in which there is any "fluff" or "fly."

RATING AND CONDITIONS.

There are several points in the matter of rating and conditions in connection with the risks which I have described which I could have wished to bring under your notice, but there are necessarily limitations to the length and nature of a paper of this description. I have, however, obtained some information as to the rating abroad, and possibly the following particulars may be of interest as showing how some of the hazards which I have mentioned are regarded.

In the New England States knitting mills are schedule rated, the base rate being 1 dollar 50 cents, and the several charges for deficiencies include the following :—

1. (*a*) Dyeing in mill (no chlorates, nitrates, or peroxides used), not less than 10 cents.
   (*b*) If chlorates, nitrates, or peroxides are used, not less than 15 cents.
   (*c*) If chlorates, nitrates, or peroxides are mixed with reducing agents and allowed to stand, or if any of the same are kept in buildings exposed to moisture, charge according to conditions, but not less than 25 cents.
2. Singeing in mill, with city or gasolene gas (latter generated outside building), not less than 10 cents.
3. Napping (*i.e.* brushing) in mill, unless in fireproof room, not less than 25 cents.
4. If not a proper supply of approved waste cans, not less than 5 cents.

The German hosiery tariff has little interest, as the rate is dependent upon the construction, height, and lighting and heating

arrangements only; but it is worthy of note that under their dyeing tariff (which appears to apply to dyeing of hosiery as well as other goods), the extra risk from oxidation is recognised, and differential rating is applied accordingly, and a condition to the effect that there is no liability for damage to goods caused by oxidation is placed on the policies.

In bringing this paper to a conclusion I must express my thanks to the many friends, both at home and abroad, who have favoured me with information and assistance in connection with the subjects which I have had the honour of submitting to you.

FAILURES OF SPRINKLER INSTALLATIONS AND THEIR CAUSES.

By THOS. A. BENTLEY, Esq.

A Paper read before The Insurance Institute, Manchester, 28th January, 1904, revised to date.

The record of the many serious fires that have occurred in cotton mills and other works fitted with Automatic Sprinklers has been accentuated by four disastrous fires in cotton mills in Lancashire, during the last two years, which resulted in the total destruction of the mills, although each was fitted with an automatic sprinkler installation, the sprinklers being of an approved type, and the water supplies apparently in full accord with the Fire Offices Committee Rules. These disasters have raised an uneasy feeling in the minds of all interested in these modern extinguishing appliances as to their efficiency in case of fire, but such fears may be dismissed as groundless, as there are hundreds of cases on record where sprinklers have operated successfully, and although we do not believe them to be infallible, for like all other mechanical appliances they are liable to fail occasionally, we believe that under constant supervision and when furnished with an efficient water supply, sprinklers will continue to work effectively and do all that is claimed for them by their inventors, which, it must be remembered, is only " the suppression of fires in their incipiency," and not to extinguish conflagrations. It must, however, always be borne in mind than an installation cannot act successfully without water under sufficient pressure and volume, and if this element be wanting then automatic protection is non-existent.

Notwithstanding the many apparent failures, the sprinkler engineers in this country maintain that there has been no failure of the sprinkler *per se,* and they ascribe the failures to other causes; and this opinion has recently been strongly corroborated

by the late Wm. H. Stratton, an American sprinkler engineer, and manager of the U.S. Factory Insurance Association, in a paper on "The Automatic Sprinkler" submitted to the International Fire Congress held in London in 1903. In this paper Mr Stratton asserts that

"THE SPRINKLER HAS NEVER FAILED,"

and he gives the following reasons to support this contention:—

"In further reference to this particular question of "protection, I desire especially to make record here in a public "expression that the printed statements that have appeared "from time to time referring to 'failure of automatic "sprinklers' cause a wrong impression and are unjustly made. "There never yet has been a failure of automatic sprinklers "where they have been installed and maintained in keeping "with the principles of the device. The principles of the "automatic sprinkler are that it must be installed to cover "all portions of a property; that it must be supplied with "water under sufficient volume and head; that it is only "designed to check a fire in its incipiency, and should not be "expected to put out conflagrations or fires in materials that "water will not extinguish—such, for instance, as burning oils "and varnishes.

"Confined strictly to the ordinary conditions of manu-"facturing or mercantile properties, properly installed and "maintained, it has never failed, but has always more than "met the expectations of its advocates and supporters."

This statement is a strong one to make, but it is made by a man of wide experience and acknowledged ability as a sprinkler engineer, and it is one in which we can generally concur, assuming, of course, that the sprinklers are of an approved type and properly equipped, as specified by Mr. Stratton. In giving expression to this opinion, we must at the outset explain that we discriminate between a

"SPRINKLER FAILURE" AND AN "INSTALLATION FAILURE."

In other words, the sprinkler heads and their fittings may be perfect in every respect, but if they have no water, or if the water is turned off before a fire is thoroughly extinguished, or if they are

not effectively supplied with a sufficient pressure and volume of water, then any failure is due to the water installation and not to the sprinklers. A sprinkler installation, however perfect, cannot work successfully with water under deficient pressure, and this is all that Mr. Stratton's statement means, and all our agreement *with him in this respect* implies.

The recent fires in Lancashire cannot be looked upon as anything but serious failures of the sprinkler installations with which the mills were fitted, but whether this failure was due to the sprinklers or to the water installation we do not propose to enquire at present, as we shall deal with this point later. Serious as were the failures, it may be a "blessing in disguise" if the cause can be clearly established and the ascertained defects avoided in the future; and it is to this point that we wish to call attention, in the hope that we may discover the cause and ascertain whether previous failures in other sprinklered risks, to which we shall refer, have occurred under similar circumstances, and, if so, what is the remedy.

Before proceeding, however, it will be necessary to digress a little to enquire into the occasion that called forth the "sprinkler," and the conditions upon which it relies for efficiency, so that we may determine whether the standard set up at the time of their introduction is being maintained.

For some ten years prior to 1882 (the date of the introduction of sprinklers into Lancashire) the physical hazard of all textile and other manufacturing risks had greatly increased owing to the growing increase in the size of mill buildings and the crowding into one structure of a greater number of possible hazards, combined with the quickened speed of machinery, with a result of a larger number of disastrous and quick-spreading fires in the large textile manufactories, involving heavy losses of property. This state of things called for some quicker and more expeditious method of dealing with fires than the existing system of private and public fire brigades, and as "necessity is the mother of invention," the automatic sprinkler was the outcome of this desire. Its inventors claimed for it that it was fully designed to meet all requirements, and was the only device by which fires could be extinguished in their inception.

The new sprinkler system relied for its success upon the following conditions:—

1st. The sensitiveness of sprinkler heads (155° F.);

2nd. The sprinkler heads to be fixed in distributing pipes of given sizes and not more than 10 feet apart;

3rd. Every installation to be fitted with two separate and adequate sources of water always available,

together with effective installation of main supply pipes, valves, tank, water pressure, and other mechanical details. These we do not propose to particularise, as they do not come within the province of this paper; we merely indicate the principal conditions of an installation to show that its effectiveness depends upon mechanical appliances and water under sufficient pressure to enable the sprinklers, when automatically opened by fire, to distribute water over the fire without waiting for any human aid to bring them into operation.

There are several thousands of sprinkler installations in various classes of mercantile, textile, and other risks in this and other countries; and in fires that have occurred in premises fitted with this modern appliance they have generally acted promptly, extinguishing them at the outset with a comparatively small fire loss, or, if not extinguished in their incipiency, they have held the fire in check until the ordinary fire appliances could be brought into use; but there have been "failures" in several installations, and it is these "failures" and their causes that we now wish to consider for a short time.

We have already expressed our opinion that sprinklers under proper conditions "cannot fail to operate"; but an opinion is not necessarily a fact unless it is backed up by statistics or some other proof, and we have therefore prepared as full and complete statistics bearing on the subject as is within our attainment. Whilst we do not claim that they are strictly accurate, still they are as correct as it has been possible to make them with the limited time and means of collaboration at our disposal, and they are sufficiently correct to enable us to justify our statement and prove that it is based on facts drawn from the experience of the working of sprinklers during the last 20 years in Great Britain. It would, of course, have been more complete if we could have given the experience of other countries, but as we have not the necessary information we have confined ourselves to the experience of the working of sprinklers in our own country since their introduction in 1882.

The number of sprinkler installations in Great Britain is about 2200, and increasing every year, and the number of fires reported

in sprinklered risks from their introduction up to date is 810. Of these 810 fires, 737, or 91%, have been extinguished successfully by the sprinklers, but of the remaining number, 73, or 9%, the sprinklers failed to stop the fires in their inception and thereby caused serious losses, and it is these cases that are classed as "sprinkler failures"; and although these "failures" are a small percentage of the number of fires that have occurred in sprinklered risks, they are of sufficient importance to call for a close scrutiny into the causes that led to the sprinklers being unsuccessful in holding the fires in check, and why they failed in the object for which they were designed.

From our investigations of this subject, we find that there are two classes of failures, and they may be classified as follows:—

PARTIAL FAILURES,

$\left.\begin{array}{l}\text{TOTAL}\\\text{AND/OR}\\\text{SERIOUS}\end{array}\right\}$ FAILURES,

and we consider this division absolutely necessary to arrive at a right appreciation of the value of sprinkler protection.

In "partial failures" we include all fires that have resulted in losses of over £1000 and up to £5000, and in Serious and/or Total Failures all fires above £5000, or that have resulted in the total destruction of the premises; and as these failures are of the utmost importance, we have tabulated the particulars of the causes in each class as far as we have been able to ascertain them.

Taking these two divisions in their order, we find that the 73 failures before mentioned, divided over the two definitions, give the following results, viz:—

Partial Failures ..	54	or 6·7%	of the total number of fires in sprinklered risks.
Total Failures, ..	19	or 2·3%	
	73	9%	

The small percentage of the *total failures* justifies us, we think, in eliminating them from the 73 so-called failures, and enables us to deal with each class of failure on its merits.

We have prepared a list of all these "failures" with the causes of failure under each section, and maintaining the order as above, we will examine the partial failures first, but, owing to their number (54), it would be tedious and wearying to emunerate par-

ticulars of each case, so we have therefore summarised them, which will serve our purpose, as it crystallises the subject and enables the causes to be appreciated under the different classifications :—

SUMMARY OF CAUSES OF PARTIAL FAILURES IN 54 SPRINKLER INSTALLATIONS.

In 17 cases,	sprinklers opened—	Completely extinguishing the fires. Damage chiefly water damage.
In 27 ,,	,,	But mill appliances and/or Fire Brigade were used in addition, and the large losses were chiefly caused by water from the Brigades.
In 1 ,,	,,	But gong was frozen, no alarm given ; large water damage.
In 4 ,,	,,	But water turned off too soon ; fires broke out again.
In 1 ,,	,,	But stop valve on pump connection not opened in time and brigade broke windows of mill. Day was stormy and wind fanned the fire, which overcame the sprinklers.

In 1 case, fire started in non-sprinklered building, which was destroyed, and set fire to a sprinklered mill, but the fire was too fierce for sprinklers.

In 1 ,, fire got into blind attic, which was not protected with sprinklers.

In 1 ,, was through the *sprinklers failing* to open through the *valves sticking.*

and 1 ,, cause not ascertained.

54 Fires.

Now with regard to "total failures," there have only been 19, or 2·3 per cent., of the total number of sprinkler fires, as before mentioned; but although the number is small compared with

those of "partial failures" they are of vastly more importance, owing to the great destruction of property involved, and it will be interesting to note in the tabulated list of these losses the assigned causes that have prevented the sprinklers being operative; and the causes may also be instructive to all interested in sprinklers, and be a help in ascertaining the defects in the sprinkler system calling for remedies to prevent the continuance of the fire waste resulting from these disastrous failures.

SUMMARY OF CAUSES OF TOTAL FAILURES IN 19 SPRINKLER INSTALLATIONS.

6	Cases	failed through—	Defective water supply or weak pressure in towns' mains.
3	"	"	Fire extending into blind attics not protected with sprinklers.
3	"	"	Imperfect installations, viz:— 1. No tank. 2. Sprinklers only in top floor of a drying stove. 3. Pump inefficient.
3	"	"	Water being turned off too soon.
2	"	"	Main stop valve closed and no water in installation.
1	"	"	Inflammable nature of goods overcame the sprinklers. (Linoleum works.)
1	"	"	Cause not ascertained.
19 Fires.			

The analysis of these 54 *partial* and 19 *total* failures shows that there has only been *one* failure of sprinkler heads under the influence of fire, and this was only a partial failure loss; but among the list of total failures there has *not been a single failure* of the sprinkler heads, 70 of the remaining failures being due to—

Defective water supplies,
Blind attics not protected,
Imperfect installations,
Water turned off too soon after fire,
Main stop valves shut down,
Highly inflammable goods overcame sprinkle

as fully described in the summary just enumerated; but in all the cases, except the one mentioned, the sprinklers opened satisfactorily, and only failed partially or totally to extinguish the fires from the causes assigned; and in the case of the "partial failures," although they were not able to stop the fires in their inception, they held the fires in check until they could be extinguished otherwise, thus proving that they were the means of preventing what might otherwise have been total losses had the premises not been protected with automatic sprinklers.

With regard to the isolated case of the "sprinkler failure" just mentioned, we think it is very desirable to give a brief description of this exceptional case, in justice to the good reputation in which the sprinkler was held, and the reason of the failure, so far as can be ascertained.

The fire occurred in a mixing room of a cotton mill fitted with this particular sprinkler, and the levers of 34 sprinkler heads were released so far as the solder was concerned, which should have brought the whole 34 sprinklers into operation, but in 13 of the heads the deflectors stuck to the valve seating and did not discharge any water, and the fire had to be extinguished by the remaining heads, assisted by the Fire Brigade, resulting in a heavy loss through water damage.

After this failure, 12 sprinkler heads were taken from the mill and officially tested by sprinkler experts, with the result that 10 tested with tank pressure failed to open through the deflectors sticking to the valve seats in the same manner as occurred in the actual fire.

The sprinkler was an approved one of a modified type, and has done good service in the past, but the failures both under fire and testing were considered so serious that it has since been officially condemned for all new installations, and ceases to be an approved sprinkler under the Fire Offices Committee rules.

With regard to other causes of "partial failures," it will have been noticed that the two principal causes number 44, and are due to water damage, and when we use the words "partial failures" in these cases the failure is gauged by the amount of damage sustained. In these 44 (out of the 54) cases which come under the category of water damage, we find the first 17 fires in the summarised list were completely extinguished by the sprinklers, and the question naturally arises why there should be a serious loss when the sprinklers operated successfully. This is

easily explained. The fires have generally occurred through friction in the spinning mule carriage of a cotton mill (which for our purpose we shall describe as an enclosed elongated wooden box), and the fire is thus confined, spreading in the inside of the carriage over the inflammable materials contained therein, and it takes a little time before the fire burns through or rushes out of the end of the carriage and raises the temperature sufficiently to liberate the sprinklers; but when the fire is emitted it becomes so fierce that a large number of sprinklers are liberated at one time, causing a heavy discharge of water, as each sprinkler discharges 14 gallons of water per minute under the required head pressure of 10lbs., and whilst ultimately subduing the fire, the water percolates through the floors below and causes serious water damage.

The second cause of serious damage, of which 27 cases are recorded, is owing to private and public brigades' appliances being utilised in addition to the sprinklers from want of an intelligent appreciation of what the sprinklers would do if they were left alone, and this flooding of rooms by the combined efforts of the sprinklers and the brigade is one of the most fruitful sources of heavy losses through water damage, and are called "sprinkler failures."

There is only one other cause under these "partial failures" to which we wish to refer, and that is the cases where water is turned off too soon owing to the mistaken notion that the fires were extinguished, and in the four cases of which we have record the fatal mistake has been made of assuming that the fires were out, and the water turned off the installation; but the assumption has been erroneous and the fires have burst out again, and before the water could be turned on again into the installation the fires assumed such proportions as to cause serious loss both from fire and water.

The remaining causes of "partial failures" need not call for any further remarks than what is contained in the summary, only to emphasise that one of them *was* due to a *sprinkler failure*, particulars of which we have already explained.

Turning now to the "total failures," which is the most important part of our subject, there are six separate and distinct causes assigned for 18 out of the 19 "total failures," and it is to these failures that we wish to give special consideration.

Commencing, then, from the bottom of this list, we find that

there is one case caused by the inflammable nature of the stock overcoming the sprinklers, and this, briefly, is a case of a spirit fire, given off during the process of drying in a linoleum drying stove; the sprinklers operated, but the fire travelled along the cloth into the top room of the works and assumed serious proportions through igniting varnish in this top floor: the fire became too great to be coped with by sprinklers, and the premises were destroyed.

The next cause which requires special emphasis are three cases where the main stop valve was closed, and consequently there was no water in the installations. In one case (a theatre) the stop valve had been deliberately closed by an evil-disposed person, who was afterwards discovered and prosecuted and served a term of imprisonment. In the second case the stop valve had been closed for the purpose of making alterations and extensions in the installation, and whilst these alterations were in progress a fire unfortunately occurred, one mill being gutted and another partially destroyed through want of water in the installation. In the third case the water was turned off after the fire had apparently been extinguished, but the fire again broke out and destroyed the mill.

There are thus three cases which were caused by water being turned off too soon in a similar manner as that described under this head in the "partial failures," but, unfortunately, in these three cases the losses were made total through the mistaken action on the part of those concerned in shutting off the water before ascertaining definitely that the fires were thoroughly extinguished.

There are also three cases caused by the fire extending into blind attics not protected with sprinklers, resulting in total destruction of the premises protected; but fortunately this cause cannot now occur, as all blind attics are now required to be protected by the Fire Offices Rules, so that we do not look for a repetition of such disasters from this particular cause.

Another cause of these failures has been through imperfect installations, of which three are recorded in our summary, and it would be instructive to refer to these for a few minutes, as they have had an important bearing upon the improvement of sprinkler installations since the disastrous fires occurred.

The first of these fires occurred at Messrs. Todd & Higginbotham's mills in Glasgow, resulting in the heaviest loss that has ever occurred in a sprinklered mill. The mills were originally fitted

with the earliest "Parmalee" sprinkler, and at the time of the fire this installation was being transformed into a "Grinnell" installation. There was no tank in the "Parmalee" system, though one was in course of preparation, but not fitted, and the installation depended upon two supposed automatic pumps. These pumps, however, turned out not to have been automatic, and a good deal of time appears to have been lost in getting the pumps to work, by which time the fire had assumed such proportions that the installation was powerless to suppress a conflagration for which sprinklers were never intended, and the consequence was that the premises were destroyed. This was one of the earliest so-called "sprinkler failures"; but it was not correct to so designate it, because the installation was a defective one at the time, and was originally fitted before the F.O.C. rules were issued.

We have now arrived at the last of the causes of the "total failures," and under this class there are six failures (the largest number in any of the assigned causes), and these six failures have been, unfortunately, all due to defective water supply or poor pressure in the towns' mains.

This is the most serious aspect of the whole so-called failure of sprinkler installations we have reviewed, for it reveals the fact that a continuance of such failures may occur at any time unless some official action is taken to protect installations against a defective pressure and volume of water, which arises from so many causes. The subject is one upon which a special paper might be written, as it involves so many scientific and technical points which we cannot fully discuss, and we shall therefore confine ourselves to the facts bearing upon the cases we propose to submit in illustration of this serious defect.

A weak or defective water supply would appear to indicate that the installation was not in accordance with the installation regulations, but it is quite possible that the town's water supply may be weak, and that the installation is strictly in accordance with such regulations.

The rules for automatic sprinkler installations provide for a pressure at the highest sprinkler of at least 10 lbs. to the square inch, and as long as the gauges register this pressure the installation is in strict accordance with the requirements. This pressure is a standing pressure, shown by gauge on the town's side of back pressure valve on towns' water main, and so long as this water is not tapped by a sprinkler discharge or by fire hydrants the

pressure will remain as shown on the gauges and be in strict accordance with the rules. There are three gauges connected with an installation which register pressures at three different points, the first being the pressure above the alarm valve, the second being on the supply pipe below the main stop valve and alarm valve, and the third being on the branch from the town's main outside the back pressure valve on such branch pipe.

To obtain the regulation pressure of 10 lbs. on the top line of sprinklers these gauges must register at least 40 lbs. water pressure for a four-storey building, and if these three gauges indicate this pressure, then the installation may appear to be in perfect order as far as the requirements of the rules in this respect; but it must be borne in mind that this is simply "standing pressure," and there is no means of showing what the pressure and volume would be when the water commences to flow, and unless there is a *running pressure* equal to the 10 lbs. requirement on the highest sprinkler, the pressure would immediately drop the moment the water was brought into use, and the pressure would be reduced according to the volume of water in the mains. This is the whole secret of the "weak pressure of water," and in the absence of any regulations requiring a test for *running pressure* there is no system of ascertaining if the pressure and volume in the mains could be relied upon to give the required 10 lbs. on the highest sprinkler in case of fire for efficiently feeding the installation.

Although this statement may be paradoxical it is easily explainable. The standing pressure in any main will record itself correctly on a gauge although the water might have but an inch of space in a six-inch or four-inch pipe, otherwise made up through any cause, and that pressure would be maintained on the gauge so long as no water was required; but the moment the water is tapped for any purpose, then the pressure might suddenly fall because of the want of *volume* to maintain it, and this pressure is lost through friction in the main pipes caused by corrosion or silting up with mud, which interferes with the volume of water, and consequently there is not sufficient pressure and volume left to maintain the 10 lbs. head of water to feed the highest sprinkler.

Coming now from a general description to particular cases, we could cite many cases from experience, but we will take one of the six cases we have mentioned as an illustration, for it is a typical case of all such failures of weak pressure of water in towns' mains.

The mill was fitted with an approved installation and the gauges registered sufficient pressure to give a 10 lb. pressure on the highest sprinkler, as required by the Fire Offices Committee rules. A fire started in the top spinning-room whilst the machinery was in motion, and is supposed to have been caused by a spark, generated through friction, firing a mule carriage and spreading inside very rapidly to the farther corner of the room, and broke out in three places almost simultaneously, causing about 20 sprinklers to open, which kept the fire in check for about forty minutes until the tank was emptied. On making inquiries the day after the fire, we found the town's main to be a 6-inch pipe 14 years old and connected with another 6-inch pipe much older and about one mile in length, and this latter pipe is taken from an 8-inch main. Upon the 6-inch main at the mill being tested by a *running* test, the volume of water was so weak that if nine sprinklers opened in the top spinning-room there would not be 1 lb. of pressure to supply same, therefore the tank would come into operation and continue to supply the sprinklers until the tank became exhausted, and then nothing could save the mill, for the simple reason that the town's water could not supply the sprinkler heads already opened, after the tank had become empty, owing to weak pressure and volume of town's water supply.

The following are the tests refered to in this case, viz:—

1st.	Stand pipe on main opposite mill gave "standing pressure" of 65 lbs.			
2nd.	,,	,,	,,	with a 2-inch open end reduced pressure from 65 lbs. to 16 lbs.
3rd.	,,	,,	,,	with a $1\frac{1}{2}$-inch open end reduced pressure from 65 lbs. to 20 lbs.

These two "*flowing*" or "*running*" pressure tests show that the town's main was useless for sprinkler purposes.

There are many instances where the town's pressure is equally deficient, and one particular case occurs to us at the moment where the standing pressure was registered on the gauges at 100 lbs., but the moment a 2-inch hydrant was fixed on the main and opened then that pressure dropped down to 6 lbs., rendering the supply to the installation ineffective so far as the town's supply was concerned.

We could mention a number of similar instances, but this is sufficient to illustrate our point, and we consider that the only way to guard against such weak towns' supply is to ascertain the "*running pressure*" of all mains supplying automatic sprinkler installations, and not the "standing pressure," which at present is all the rules require.

We have attempted to deal with this question of sprinkler failures in a fair and impartial manner, and have adduced facts to prove our opening statement, that the sprinklers *per se* are not the cause of the failures, but the water installation. And whilst many of the causes of failures have been removed through the adoption of more stringent rules than existed in the earlier days of installations, still, as history repeats itself, so will "sprinkler failures" occur again; but they might be minimised, and the fire loss curtailed, by providing additional regulations or rules for testing the "running" pressure of water in all mains supplying automatic sprinkler installations. If such tests revealed the pressure and volume of water to be weak and inefficient, then a pump or other source of supply should be substituted that would maintain the regulation 10 lbs. head of water on the highest sprinklers and make installations thoroughly effective; but in installations where a pump is one of the sources of supply, an automatic pump should be installed and not a *non*-automatic one, as at present allowed by the rules, because a non-automatic pump is dependent upon human agency to set it in motion for feeding the installation, and experience has given several instances of fires at which such pumps have not been set in motion at the right time, consequently there has only been one supply (tank) for a time, and if this tank supply becomes exhausted before the non-automatic pumps get into action, the probability is that the premises are destroyed and regarded as another "sprinkler failure," when the failure is due to the water installation and not to the sprinklers.

METHODS OF DIVISION OF THE SURPLUS OF LIFE ASSURANCE OFFICES.

By WILLIAM TAIT, F.F.A.,
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WHEN I was asked by your council to write on the above subject, while feeling deeply the honour attaching to such a request, I was assailed with a feeling of doubt as to my ability to deal effectively with such an important subject, and at the same time felt that, as it had already been exhaustively treated by eminent members of the profession, there was little or nothing left to be said of an original nature. From the outset, therefore, I would like to say that what follows is more in the nature of an attempt to condense and put in a comprehensive fashion what has already been written by various authorities upon the subject, than an essay to put before you anything new or original.

I think it just as well to begin by defining what is the surplus of a Life Assurance Office, and from what sources it generally arises.

Surplus is the balance that is left over after the actuarially-ascertained value of the liability of a Life Office under its contracts at a given time has been subtracted from the value or amount of its Life Assurance and Annuity Fund at such given time. Incidentally, without entering into the actuarial matter of the basis of valuation of the liabilities, I would draw attention to the matter of the valuation of the assets of the Life Assurance Fund in view of the very serious financial times that several offices have experienced during the past two or three years, involving the writing off of several hundreds of thousands of pounds from the values of securities as they had formerly stood in the books of the companies. It has been held, when the question of such valuation of assets came up at an investigation with a view to a

lapsed policies, &c. As is well known, companies do not, as a rule, allow the full reserve value of a policy on its surrender, but make a deduction therefrom, on account of loss of a contributive factor to the profits of the future, and the effect which withdrawals are understood to have upon the rate of mortality amongst assured lives. Among miscellaneous profits might be mentioned any profit that arises from the working of the non-participating branch of Life Assurance and Annuity business.

Mortality Profit is the profit arising from a favourable death experience. There are various methods by which this factor in the profits of a Life Office may be ascertained. The late Mr. Meikle said it consisted of—

1st, the premiums (with interest) paid by the long livers during their prolonged life (*i.e.*, the number of years by which they have exceeded their expectation of life according to the table of mortality employed) to date of investigation;

2nd, interest on their sums assured from date when claim due, by calculation, to date of investigation;

3rd, the sums assured of those who have survived their expectation, less the values of their policies at date of investigation.

Another method of calculating or ascertaining the profit from mortality was propounded by another eminent actuary as follows:—

"To the reserves made for policies at the beginning of any year "increased by a year's interest, add the difference between the net "or risk premiums and the claims for the year, increased by half "a year's interest (to allow for the incidence of both claims and "premiums falling due), and deduct the reserves at the end of the "year, the result will be the exact profit or loss from mortality "during the year."

Having thus discussed very briefly the principal sources from which the surplus of a Life Office arises, let me now proceed to make some observations illustrative of the various methods in use for disposing of, or distributing, such surplus among the participating policy-holders.

In the first place, it will have been noticed that very often the whole of the ascertained surplus is not distributed amongst the

participating policy-holders of a Life Office, a certain proportion of it, quite apart from the proportion allotted to shareholders, in the case of a proprietary company, being carried forward to the next valuation account. This is sometimes necessary to counteract adverse and unexpected circumstances which may arise in the future, and which might result in a reduced rate of bonus being declared—such as the heavy fall in the market price of securities which recently took place. The creation of, say, an Investment Reserve Fund, by reserving a proportion of the surplus in times of prosperity to meet such a depression as I have referred to, may and does make all the difference in the future prosperity of an office that has a fund of the kind, compared with one that has not made such a provision.

Another reason that sometimes requires the holding over of a portion of the surplus is the necessity for making preparation beforehand for a reduction in the rate of interest at which the next valuation will have to be calculated, so as to place the reserves of the office on a sure and secure basis.

The principal methods of dividing surplus that I propose to deal with are:—

(1). Contribution Method.

(2). Simple and Compound Reversionary Systems.

(3). Cash Bonuses, Reductions of Premium, and certain Miscellaneous Systems.

(4). Discounted Bonus Plan.

(5). Tontine Bonus and Deferred Bonus Systems.

Contribution Method.

The most elaborate, or one of the most elaborate, systems for distributing surplus was devised by Mr. Sheppard Homans, an American actuary, who, I think, first called his system the Contribution Method. His scheme was to keep a sort of debit and credit account for each policy in the following way:—

Credit.	*Debit.*
(1) Value of Policy Reserve at last preceding distribution of surplus, accumulated at rate of interest realised.	(1) Actual cost of risk incurred during the valuation period, determined by means of a table representing the rates of mortality and interest actually experienced.
(2) Premiums, less expenses, paid since last distribution, accumulated at rate of interest realised.	(2) Amount now reserved at date of distribution as the value of the policy.

The difference between the sums of these two columns represented the contribution of the policy-holder towards the surplus to which he was entitled.

As can be imagined, the above system was very cumbrous and too elaborate to be of much practical use. Moreover, it is not strictly accurate. The risk premium, for instance, is the same for all those of the same age, whatever may have been the length of time for which the policy-holder had been insured, so that, therefore, no account is taken of the important part played by the selection exercised by medical examination in the case of recently assured lives. The time covered also (a valuation period) is too short in which to frame a mortality table. Notwithstanding these objections, however, the system takes account of the important factors for determining the exact contribution made by each policy to the general surplus, and has served as a standard for other systems.

The system or method of distribution of surplus described by Dr. Sprague, and known as "Sprague's Method," after the name of its inventor, or the "Equity and Law Method," from the name of the office to which it was first applied, follows Mr. Sheppard Homan's contribution method; but, while preserving to a great extent the advantages of that method, Dr. Sprague's plan avoids the complicated and somewhat cumbrous processes, in consequence of which, and of certain theoretical objections, Mr. Homan's method has failed to receive much support from British actuaries.

In his description of his method Dr. Sprague says:—"If the "average rate of interest at which the total funds, inclusive "of bankers' and agents' balances, and other unproductive assets, "are improved exceeds the rate at which the valuations are made, "it is clear that a profit will be realised in the nature of excess of "interest on the amount of the funds at the last valuation, to "which profit the new members have contributed nothing. Let "the amount of profit so earned by each of the old assured still "remaining on the books be ascertained and appropriated to his "policy. For example, if the valuations are made at 3 per cent. "interest, and the average rate realised has been £4 8s. per cent., "then the reserve made for each participating policy at the last "valuation (five years ago) is to be multiplied by $\cdot 0809 = (1\cdot 044)^5$ " $-(1\cdot 03)^5$, and the product will be the profit to be in the first "instance appropriated to the policy. The sum of all these "amounts being found and subtracted from the surplus divisible

"among the assured, there will remain a sum which may be "fairly divided among all the assured in proportion to the "premiums (without interest) they have respectively paid since "the last valuation. As regards persons of the same age at "entry, it is clear that, apart from the effect of selection, the "profit on their current premiums must be nearly the same "whenever their policies were effected; and if the premiums are "loaded with a percentage on the net premium, or approximately "so, the distribution of the surplus in proportion to the premiums "paid will give very fair results. This method will have the "effect of giving larger cash bonuses to the policies the longer "they have been in force, but not unreasonably or unfairly so."

It will be seen from the foregoing description that the fundamental principle underlying Dr. Sprague's method is to make a broad division of the surplus into two parts, which are distributed according to different systems. The first part, consisting of surplus interest profit earned over and above the rate of interest assumed in calculating the reserves under participating policies at the last valuation, is divided in proportion to such reserves upon which the excess rate of interest has been realised. The second part embraces the whole of the remaining surplus (including the profit from loading, lapses, surrenders, and other miscellaneous sources of surplus, increased or diminished by the profit or loss from mortality), and is distributed in proportion to the tabular premiums paid in the valuation period.

In certain modifications of Dr. Sprague's method the remaining portion of the surplus, other than that derived from surplus interest, is distributed according to the loadings paid in the valuation period, instead of in proportion to the tabular premiums paid, as in the method just described. Dr. Sprague, in his description of his method, stated that if the premiums were loaded with a percentage, or approximately so, then the division of the surplus in proportion to the premiums paid would give very fair results, from which it would appear that, in the event of the premiums not being so loaded, some modification would be both necessary and desirable. In such conditions the loading system, as it has been called, is better suited than Dr. Sprague's system of distribution according to premiums paid. Mr. Lidstone, in his valuable paper on the "Distribution of the Divisible Surplus of a Life Assurance Company" (*Journal of the Institute of Actuaries*, vol. xxxii.), to which I am indebted for a great deal

of my information, states that the practice of offices is equally divided on the above point, for out of eight British offices which have adopted Dr. Sprague's principles, four adopt the loading system and four the premium system.

Before passing from the discussion of the contribution method I give a brief description of the method adopted by Mr. T. G. C. Browne, which is a modification of the methods above mentioned. A fully detailed description is given in vol. xxxii. of the *Journal of the Institute of Actuaries*; but, briefly put, his method was to divide the surplus into three groups:—

Group I.—comprised loading (less expenses and commission), profit from surrenders, and lapses.

Group II.—comprised interest earned above valuation rate, and interest earned on reversions at an assumed rate.

Group III.—comprised miscellaneous profits, such as—

(1) profit or loss from mortality;
(2) profit from investments realised, including the profit from reversions, less the assumed rate of interest included in Group II.;
(3) profit on bonuses from re-assurances;
(4) interest on investment reserve fund, interest on undivided balance from preceding period, and on accrued profit;
(5) profit or loss from issue policies; and
(6) profit or loss from annuities.

Mr. Browne then increased or decreased Groups I. and II. according to their rateable proportion to Group III., and divided Group I. according to the loading received in the valuation period, and Group II. according to the reserve values held for the policies at the end of the valuation period. His object in creating a third group, to be rateably divided between the other two, was necessary, in his opinion, to make the contribution method work satisfactorily in times of adversity as well as prosperity, and for that purpose he included in his third group all important items which tend to fluctuate greatly from period to period.

I now give, by way of illustration, two tables showing the bonus additions to a policy for £1000, taking the age at entry as 30, one table illustrating the working of the contribu-

tion method as applied to a whole-life assurance, and the other as to an endowment assurance payable at age 60 or previous death. These tables are extracted as examples from a number of illustrative tables given by Mr. G. J. Lidstone in his paper previously referred to. At the end of the tables are given examples of the results obtained under the compound reversionary bonus system, the rate assumed being 30s. per cent. per annum allotted quinquennially. The results obtained are subject to the following conditions, viz.:—

(1) That the office annual premiums are—
 (*a*) £2 9s. for whole-life assurance, age at entry 30.
 (*b*) £3 8s. for endowment assurance payable at age 60 or previous death, age at entry 30.

(2) That the valuations are made on the basis of the combined H^m and $H^{m(5)}$ Institute of Actuaries' Mortality Tables, with interest at 3 per cent.

(3) That the rate of interest earned is $4\frac{1}{8}$ per cent. per annum.

(4) That the participating whole-life assurances are to the participating endowment assurances in the ratio of 10 to 1.

(5) That the total amount of profit divided is equivalent to the whole of the surplus interest profit, plus the whole of the loading calculated according to Sprague's Select Mortality Tables at 3 per cent. interest. Expenses are assumed to be covered by miscellaneous profits, such as mortality profit, profit from investments, &c.

Heading (1) shows the bonus from surplus interest; heading (2) shows the bonus from other sources, *i.e.*, loading, &c.; heading (3) shows the bonus from surplus interest on the reserves in respect of bonus additions existing at the beginning of any quinquennium.

[Table.

TABLE II.

Whole Life Assurances—Age at entry, 30.
Bonus Additions to a Policy of £1000 in respect of the under-mentioned Years of Assurance.

System of Allotment.	Profit arising under Heading.	Years. 1-5	Years. 6–10	Years. 11-15	Years. 16–20	Years. 21–25	Years. 26–30	Years. 31–35	Years. 36–40	Years. 41–45
Contribution Method. — Premium System.	(1)	5·8	14·9	21·4	27·6	33·1	38·0	42·3	45·8	48·9
	(2)	59·0	54·1	49 6	45·3	41·5	38·2	35·3	32·9	30·9
	(1) + (2)	64·8	69·0	71·0	72·9	74·6	76·2	77·6	78·7	79·8
	(3)	—	3·7	7·8	12·2	17·0	22·2	27·9	33·9	40·3
	(1) + (2) + (3)	64·8	72·7	78·8	85·1	91·6	98·4	105·5	112 6	120·1
	Total Bonuses	64·8	137·5	216·3	301·4	393·0	491·4	596·9	709·5	829·6
Contribution Method. — Loading System.	(1)	5·8	14·9	21·4	27·6	33·1	38·0	42·3	45·8	48·9
	(2)	63·5	58·2	53·3	48.7	44·6	41·1	38·0	35·4	33·3
	(1) + (2)	69·3	73·1	74·7	76·3	77·7	79·1	80·3	81·2	82·2
	(3)	—	3·9	8·3	13·0	18·0	23·4	29·3	35·6	42·3
	(1) + (2) + (3)	69·3	77·0	83·0	89·3	95·7	102·5	109·6	116·8	124·5
	Total Bonuses	69·3	146·3	229·3	318·6	414·3	516·8	626·4	743·2	867·7
Compound Reversionary Bonus of 30s. per cent. per annum allotted quinquennially.	Quinquennial Bonus	75·0	80·6	86·7	93·2	100·1	107·7	115·7	124·5	133·7
	Total Bonuses	75·0	155·6	242·3	335·5	435·6	543·3	659·0	783·5	917·2

TABLE III.

Endowment Assurance at Age 60—Age at entry, 30.
Bonus Additions to a Policy of £1000 in respect of the under-mentioned Years of Assurance.

System of Allotment.	Profit arising under Heading.	Years. 1–5	Years. 6–10	Years. 11–15	Years. 16–20	Years. 21–25	Years. 26–30
Contribution Method. — Premium System.	(1)	7·6	18·2	27·9	37·0	45·2	52·9
	(2)	67·5	60·4	53·8	47·6	42·0	36·7
	(1) + (2	75·1	78·6	81·7	84·6	87·2	89·6
	(3)	—	4·2	8·9	13·9	19·5	25·4
	(1) + (2) + (3)	75·1	82·8	90·6	98·5	106·7	115·0
	Total Bonuses	75·1	157·9	248·5	347·0	453·7	568·7
Contribution Method. — Loading System.	(1)	7·6	18·2	27·9	37·0	45·2	52·9
	(2)	67·1	60·0	53·4	47·4	41·8	36·5
	(1) + (2)	74·7	78·2	81·3	84·4	87·0	89·4
	(3)	—	4·2	8·8	13·9	19·4	25·3
	(1) + (2) + (3)	74·7	82·4	90·1	98·3	106·4	114·7
	Total Bonuses	74·7	157·1	247·2	345·5	451·9	566·6
Compound Reversionary Bonus of 30s. per cent. per annum allotted quinquennially.	Quinquennial Bonus	75·0	80·6	86·7	93·2	100·1	107·7
	Total Bonuses	75·0	155·6	242·3	335·5	435·6	543·3

You will observe that the results in the endowment assurance table, both for the premium and loading systems of the contribution method, coincide more closely with those obtained under the compound reversionary bonus method than do the results in the whole-life table. Especially is this the case under the premium system; but this is due, to a certain extent, to the greater share of surplus interest contributed by the larger reserves under endowment assurance policies, and, in the case of the premium system of allotment, the larger premiums paid under endowment assurances compared with whole-life assurances.

I may mention here the debatable point as to whether endowment assurance policies are entitled to a larger share of the surplus of a Life Office than that allotted to whole of life policy-holders. Some offices give a larger share, some a smaller share to endowment assurances than what is allotted to whole-life assurances, but the majority of offices give the same rate to both classes. A good deal depends upon the rates of mortality experienced in each class, the loading of the premiums, and the rate of interest realised. One important point, however, should, I think, be borne in mind, that is, if an office is transacting a large amount of endowment assurances with profits for short terms, such as 10 or 15 years, the frequent maturing of these may cause the disturbance of the office investments to meet them, perhaps, too, at a time when the money market is unfavourable for realisation, and thus cause a loss of profit. The new investments that are being made from time to time may not yield such a good rate of interest as those that had to be realised, and thus the average rate of interest earned on the funds may be adversely affected. The following table, taken from the admirable paper on "The Bonus Earning Power of Life Offices," by Mr. E. A. Rusher, F.I.A., read before the Bristol Insurance Institute, 24th November, 1899, will illustrate the effect of a fall of ½ per cent. in the rate of interest earned upon whole life and endowment assurances:—

[TABLE.

TABLE IV.

Accumulated Profit from Interest to an Office issuing under each Table 10,000 Policies for £100 each, taken out at age 30, and valuing on a basis of H^m 3 per cent.

Years.	Interest Actually Earned. 3½ per cent.			Interest Actually Earned. 4 per cent.			Years.
	Whole Life.	Twenty Years' Endowment Assurances.	Ten Years' Endowment Assurances.	Whole Life.	Twenty Years' Endowment Assurances.	Ten Years' Endowment Assurances.	
5	1,102	2,927	6,764	2,219	5,898	13,617	5
10	3,974	11,341	26,726	8,083	23,035	54,383	10
15	8,956	26,670	-	18,380	54,667	-	15
20	16,407	50,540	-	34,008	104,674	-	20

To come now to a discussion of the merits and demerits of the contribution method of dividing surplus, it may be said from the outset that it is a fair attempt to allocate the surplus equitably among policy-holders of different classes, ages at entry, and durations of policies, and under certain conditions produces very satisfactory results. It endeavours to divide the surplus according to the sources from which it has been realised, and in proportion to the rate at which it has been earned, and in so far as it attains these objects it is the ideal form of bonus distribution, doing justice to all classes of policy-holders. There is one serious fault in it, however, that is referred to by Mr. T. E. Young in his "Notes upon Certain Methods of Allotting Surplus," published in the *Journal of the Institute of Actuaries*, vol. xxxvii.

When the general reserves of a company are increased by the adoption of a higher rate of mortality or a reduced rate of interest, the requisite amounts are derived from the general resources of the company, including the contributions of the new policies; hence the older policies obtain their enhanced protection partly from the payments of fresh entrants, and then receive the surplus interest upon the augmented reserves thus obtained. The basis of allotment for new policies is that of the office premiums alone in the case of Dr. Sprague's method, or, as in

modifications of that plan, the loadings of the premiums alone. As the portion of the surplus allocated to new policies under the contribution method is that remaining after the amount arising from surplus interest has been ascertained, and as that is the portion of the surplus that has to bear principally all adverse fluctuations of any kind, it is another fault of the method that new entrants are taxed with certain adverse fluctuations of mortality, such, for example, as may have been occasioned by the older policy-holders. Another objection is that, as time proceeds, the older policies with their increasing reserves will more and more completely absorb the major portion of the surplus. This effect will be intensified when we consider the vast augmentation of endowment assurances, especially those of shorter terms, and the considerable reserves required. Put briefly, the above objections point to the fact that under certain conditions the contribution method allots too small a share of the surplus to new policies, and too large a share to old policies.

I think I have dwelt at sufficient length upon the contribution method, so turn now to a consideration of the

Simple and Compound Reversionary Bonus Systems.

Mr. H. W. Andras, F.I.A., in a paper read before the Institute of Actuaries on the above subject a few years ago, estimated that about half the number of ordinary Life Offices in the United Kingdom adopted the above, which he called the staple form of bonus distribution, either in the simple or compound manner.

It seems scarcely necessary, therefore, to explain that under the above systems the reversionary bonus allotted is calculated as a percentage per annum on the sum assured only in the case of the simple reversionary bonus, or on the sum assured and existing bonus additions, in the case of compound reversionary bonuses, for the number of years the policy has been in force, *or* for the number of years' premiums due and paid during the valuation period.

There is a point which I think it well to mention here, and that is the variation amongst the different Life Offices in regard to the time which must elapse before an allotted reversionary bonus becomes a vested addition to the policy. In some offices the bonus vests at once, no matter how short a time the policy may have been in force, but in the majority of cases there is a

period from the date of assurance which must elapse before any allotted bonus vests. This is considered necessary on account of the heavy initial expenses incurred in procuring the business. The period varies from one year or one annual premium paid to five years or five years premiums paid.

It has been urged in connection with the simple and compound reversionary bonus systems, that the premiums charged by the offices adopting these systems should have their loading for profit calculated with a view to the particular system, and this is necessary if absolute equity is to be maintained as between entrants at different ages. But scales of premiums are often constructed on the consideration of competitive premiums, and Mr. Andras, in the paper before referred to, found on investigation that existing scales of premiums in many offices having the above systems of distribution required considerable revision in order to render their bonus distributions equitable as between entrants at different ages. It can be readily understood that under a system of bonus distribution where a uniform rate of reversionary bonus is declared irrespective of the age of the assured or the duration of his policy, that an increasing cash surplus from each policy must be earned, to provide that rate of reversionary bonus, owing to the increasing age of the assured at each valuation, and the consequent higher cash value of the reversionary bonus to be allotted. If the office premiums are loaded and the valuation reserves calculated strictly with a view to the distribution of a uniform rate of reversionary bonus at all ages, then the system is perfectly equitable. But all the office premiums charged in cases where the uniform rate of reversionary bonus has been adopted are not so loaded, nor are the valuation reserves so calculated.

I give below tables, which I have computed, illustrating the above point of the increasing cash bonus required to be earned to declare a simple or a compound reversionary bonus. I have taken a rate of bonus declared of 30s. per cent. per annum, and assumed that the valuations are made on the basis of the Institute of Actuaries' Healthy Males (H^m) Table of Mortality with 3 per cent. interest. I have given illustrations for whole of life policies. The corresponding figures for endowment assurances would involve a series of tables according to the various ages at entry and ages at which the policies mature, but they are, of course, of greater amount.

TABLE V.

Cash Values of Simple Reversionary Bonuses at the rate of £1 10s. per £100 assured per annum.

QUINQUENNIAL DIVISION OF PROFITS.

Age at Entry.	Number of Years in force.				Age at Entry.
	5	10	15	20	
20	2·686	2·942	3·221	3·530	20
30	3·221	3·530	3·875	4·246	30
40	3·875	4·246	4·640	5·046	40
50	4·640	5·046	5·442	5·828	50

TABLE VI.

Cash Values of Compound Reversionary Bonuses at the rate of £1 10s. per cent. per annum on sum assured and Existing Bonuses.

QUINQUENNIAL DIVISION OF PROFITS.

Age at Entry.	Number of Years in force.				Age at Entry.
	5	10	15	20	
20	2·686	3·161	3·724	4·386	20
30	3·221	3·793	4·481	5·276	30
40	3·875	4·563	5·364	6·270	40
50	4·640	5·422	6·292	7·241	50

It has been found by calculation that in cases where it is desired to allot a simple or a compound reversionary rate of bonus, instead of calculating at a valuation period the exact value of the sums assured and bonuses to be allocated at the highest safe rate of interest that can be assumed, and on the basis of the table of mortality that most nearly represents the experience of the office, and deducting therefrom the value of the future premiums,

actuarially loaded to provide for such rate of bonus—which would give the exact reserves required, but would involve a very great amount of trouble in computation—a valuation by the ordinary method, *i.e.*, valuing the sums assured and existing bonuses, and deducting therefrom the value of the risk premiums required for the sum assured alone, at a rate of interest below what is actually earned, was sufficient to provide for the rate of bonus desired. In the case of a simple reversionary bonus, the margin between the rate of interest realised and that assumed in the valuation necessary to declare such a bonus was found to be $\frac{1}{2}$ per cent.; where compound reversionary bonuses were desired, a margin of at least 1 per cent. was found necessary.

The chief merit of the simple and compound reversionary bonus systems is their simplicity, so far as the general public are concerned, and this has influenced the choice of many offices in adopting one or other of these methods for their bonus distribution, in the natural desire to meet the demands of likely assurers. It also appeals to the younger lives, because, as a rule, they get a larger bonus from the outset under a uniform rate of allocation irrespective of age at entry than they would under a system like, say, the contribution method just described, where the larger share of the profits goes to the older lives and policies.

The great defect of these systems, however, is their want of elasticity to adapt themselves to the varying circumstances of Life Offices. They are altogether too rigid in their nature. Another point which is specially applicable to the simple reversionary bonus system is that the bonuses are not distributed equitably amongst the policy-holders in the proportion in which they have been contributed or earned, young policies benefiting at the expense of the older policies. The compound reversionary bonus system mitigates this to a certain extent, and in offices experiencing average results it gives, as was shown, bonuses approximately the same as the contribution method, so that, in such cases, the merit of simplicity may be combined with the principles of equity.

Mr. Young, in his notes before referred to, says:—"Of the "compound reversionary system it need only be mentioned at "this point that, inasmuch as its equitable retention depends "upon a certain excess in the net rate of interest realised beyond "the valuation rate, its validity is not permanent, but diminishes "as the market rate definitely decreases." This statement has

received ample justification in recent years, where an appreciable fall in the interest rate realised has caused the reduction of the former rate of bonus declared by many offices.

Another point which may be referred to here is the effect that valuations at a very low rate of interest, with a view to producing a large margin of interest profit, sometimes have upon the margin of premium loading for future expenses and profits. In some cases the risk premiums valued have left such a small margin between them and the office premiums payable under the policies, that a sum has had to be specially taken from the surplus disclosed as a provision or reserve to provide an adequate sum for future expenses and profits from loading.

I shall close my discussion of the simple and compound reversionary bonus systems by giving the method which Mr. H. W. Manly, F.I.A., considers the proper one in order to maintain a permanent rate of simple or compound reversionary bonus. He puts it in the form of a valuation balance sheet, calculated at the highest safe rate of interest thus :—

Liabilities.	*Assets.*
(1) Present value of sums assured and bonuses.	(4) Assurance Fund.
(2) Reserve for future expenses.	(5) Present value of future premiums.
(3) Present value of a quinquennial bonus of X per cent. per annum for the past five years and for the future existence of the policies.	

Where such a value is assigned to X as will make both sides of the account balance, X would then be the rate of bonus to be declared.

I come now to a discussion of

Cash Bonus, Reduction of Premium, and Certain Miscellaneous Systems.

Some offices adopt the principle of distributing their ascertained surplus in the form of a rateable cash allotment, and this is done in the following ways:—

(1) In proportion to the accummulated premium loadings.

(2) In proportion to the accummulated premiums paid during the valuation period.

Both methods are open to the same objection, and that is, they give decreasing additions during the currency of a policy when converted into reversionary bonuses.

They are, however, equitable methods of distribution if the premiums are loaded with a view to cash bonuses, such loading being in the form of an equal percentage of the premium in each case. If the premiums are not so equally loaded, then it will be readily seen that justice will not be done to entrants at various ages.

The cash bonus system is one that does not need much explaining, being simplicity itself in its idea and mode of application. The chief, and almost sole, objection to it is the fact that it does not meet the modern requirement of an increasing reversionary bonus. This accounts for its unpopularity amongst offices, only a few adopting that method of distribution at the present time.

I give below a table which shows average specimens of reversionary bonuses per cent. per annum equivalent to a cash bonus allotment.

TABLE VII.

Average Reversionary Bonuses per cent. per annum equivalent to a uniform Cash Bonus percentage allotment.

WHOLE LIFE ASSURANCES.

Age at Entry.	Office Annual Premium.	Number of Premiums paid.				Age at Entry.
		5	10	15	20	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
20	2 0 10	1 18 4	1 15 4	1 12 4	1 9 6	20
30	2 10 1	1 16 11	1 13 8	1 10 7	1 7 11	30
40	3 5 2	1 16 0	1 12 10	1 10 1	1 7 9	40
50	4 11 5	1 17 6	1 14 6	1 12 2	1 10 0	50

Certain offices, but only a very small number, distribute their surpluses in the form of reductions of the premiums payable instead of giving cash or reversionary bonuses, but this is simply a modification of the cash bonus system above referred to, and need not, I think, be further discussed. Where the system takes the form of an annual valuation and cash bonus reduction of premium, it works very well, but where, as in some cases, it takes the form of applying allotted and vested bonuses to reduce the annual

premium payable for a certain number of years, or, as in other cases, to make the premium cease at a certain age, it does not work so well from the point of view of the insuring public if the lives assured happen to die before the term of years have expired or the required age has been reached.

There are a few systems of bonus distribution, which for lack of of a better word I shall call miscellaneous, to which I shall briefly refer.

(1) Where the surplus is distributed in proportion to the difference between the accumulated premiums and the value of the policy.

At a first division of profits this proportion is simply the difference between the premiums paid since the date of the policy till the end of the bonus period, accumulated at interest, and the value of the policy at the end of the period. At second and future divisions a new policy is assumed to be taken out at the increased age, the premiums on which are accumulated, and the value of the hypothetical policy deducted from such accumulated premiums at the end of the bonus period. This system produces increasing bonuses, varying according to the age at entry and duration of the policy.

(2) Where the surplus is distributed in proportion to the value of the policy at the end of last period, improved at compound interest, together with the accumulated premiums since paid, less the value of the policy at the end of the period.

(3) The following is a combination of the uniform reversionary and contribution bonus methods which is adopted by certain offices, viz:—The value of a uniform reversionary bonus of £1 per cent. on the sum assured, for each annual premium paid since the last division, was first allotted to each policy, and the balance of the surplus was divided, in proportion to the reserve values of the policies, at the end of the quinquennium.

The above three different systems produce increasing reversionary bonuses which vary in each case with the age at entry and duration of the policy, those entering at older ages getting a higher rate of bonus from the outset than those entering at younger ages. It will be sufficient for illustrative purposes if I give the bonuses allocated by one office as representative of the general run of those declared under the above three systems.

TABLE VIII.

Specimens of Annual Reversionary Bonuses where Surplus is distributed in proportion to the Accumulated Premiums paid less the Reserve Value of the Policy.

WHOLE LIFE ASSURANCES.

Age at Entry.	Office Annual Premium.	Number of Premiums paid. 5	10	15	20	Age at Entry.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
20	1 16 11	1 0 0	1 2 0	1 3 7	1 4 7	20
30	2 8 0	1 2 0	1 2 10	1 3 10	1 4 7	30
40	3 4 0	1 2 5	1 3 2	1 4 0	1 4 10	40
50	4 9 7	1 2 10	1 3 5	1 7 2	1 16 2	50

In discussing the above-mentioned systems, it may be briefly stated that they are equitable enough, according to the idea that the more one pays in the more one will get out. In other words, if one lives to pay many comparatively small premiums by entering at a young age, or pays fewer but larger premiums on account of entering later in life, he will receive respectively more smaller bonuses or fewer larger ones. On the other hand, from the point of view of the general assuring public and their demand, as shown by the large majority of offices adopting the uniform rate of simple or compound reversionary bonus to all entrants, irrespective of age at entry, those systems that give a larger share of the surplus to the older entrants are not so likely to attract young fresh lives as new assurers as will those systems I have just referred to.

I now come to a consideration of the

Discounted Bonus Plan. This is a system under which the ordinary premiums charged for with profit assurances are reduced by the application of the cash or discounted value of a certain rate of reversionary bonus which it is anticipated will be realised in the future.

I was surprised to learn on investigation, and I dare say others will be too, that this system has been in vogue for the past fifty years, in the case of one office at anyrate. Mr. Henry Moir, F.I.A., F.F.A., in his prize essay on "The Rationale of Discounted

Bonus Premiums" (*Journal of the Institute of Actuaries*, vol. xxxvi.), states that discounted bonus policies were first introduced by a Scottish office in the year 1854, when it was stated that the new rates of premium were founded on "a deduction of "an annual value equivalent to an assumed bonus of $1\frac{1}{2}$ per cent. "compound" (on the sum assured). It is interesting to note, as showing the economical management and prosperous nature of the business done by the office in question, that the bonus has not once fallen below the rate anticipated, which, in these days, is a fairly high rate of bonus to pay on the ordinary with-profit assurances, taking the average of the bonuses now declared, and which have been declared by offices generally, and remembering that the rate of bonus anticipated in discounted bonus tables of premiums is generally well within what the office has been paying in the past, and is likely to pay in the future.

The example set by this Scottish office was followed by a Canadian company, and introduced in a modified form by one or two British offices. Little more was heard of it until a few years ago, when it appeared as a prominent feature in the prospectuses of several British offices. Since then the system has assumed considerable proportions, until, at the present time, out of twenty-eight offices quoted in the current issue of the "Vade-Mecum" (that handy *multum in parvo* to the outside official of a Life Assurance office) as issuing low premium with-profits rates, twelve offices have adopted it. The issue of such policies to such an extent is another evidence, if any evidence was wanted, of the keen competition for business nowadays, as they meet the demand for assurance at low or cheap rates, with the advantage of reaping the immediate benefit of a bonus and the attraction of a speculative additional bonus if the future prosperity of the office will allow of it.

The rate of bonus anticipated varies in different offices, ranging from 20s. to 40s. per cent. of the sum assured. In most cases, the reason which has given rise to the adoption of the system has been that the past experience of the office for a considerable number of years showed that no lower rate of bonus than that anticipated has been declared, and the assumption is made that the future will reflect the experience of the past. Should future experience prove that too large a rate of bonus has been discounted, powers are usually reserved in policies issued under this system of increasing the annual premiums to an

adequate figure, or of correspondingly reducing the sums assured.

By way of illustration, I give below specimens of the average rates of premium charged by the twelve offices I have before referred to who have adopted the discounted bonus plan, and compared these with the corresponding average non-profit rates of the offices at different ages at entry.

TABLE IX.

Average Specimens of Annual Premiums charged by Offices granting Policies under the Discounted Bonus Plan, compared with corresponding Non-Profit Rates.

(*a*) Where Simple Reversionary Bonuses are anticipated—5 Offices.
Average Bonus anticipated, £1 8s. per £100.

Age at Entry.	Discounted Bonus Premium.	Non-Profit Premium.	Age at Entry.
	£ s. d.	£ s. d.	
20	1 12 2	1 12 0	20
30	1 19 10	2 0 1	30
40	2 13 8	2 14 4	40
50	3 17 9	3 19 0	50

(*b*) Where Compound Reversionary Bonuses are anticipated—6 Offices.
Average Bonus anticipated, £1 2s. 6d. per £100.

Age at Entry.	Discounted Bonus Premium.	Non-Profit Premium.	Age at Entry.
	£ s. d.	£ s. d.	
20	1 12 6	1 12 10	20
30	2 0 4	2 0 10	30
40	2 14 3	2 15 2	40
50	3 18 2	3 19 5	50

One of the twelve offices referred to anticipates bonus, but the amount or rate of bonus so anticipated is not mentioned.

The great advantage of the discounted bonus plan is that it gives the cover and protection of assurance to policy-holders at rates of premium in some cases nearly as low as and in others lower than the corresponding non-profit rates, while securing the privilege of the right to participate in the profits of the office. From the office point of view, if a large amount of business be done under this system, the necessity of investing and accumulating the heavier premiums payable under ordinary with-profits assurances is simplified, owing to the smaller premiums charged. Another advantage from the office point of view is that, lower premiums being charged, the commission expenses for collection are likely to be rather less than those affecting assurances at full with-profit rates, and this may have the effect of increasing the bonus earned by this class of policies.

There are, however, several disadvantages attaching to the discounted bonus plan which, although not so apparent as the advantages just mentioned, are of sufficient importance to be worthy of note. The first and most serious objection that can be raised against the discounted bonus plan is that the future experience of the office may prove less favourable than anticipated, that bonuses may fall below the rate taken credit for in the premiums, and that there will be a consequent restriction or reduction of the sums assured or corresponding increase in the premiums payable, which may and in all probability would have the effect, for a time at least, of shaking public confidence in the office. The prospectuses of offices putting forward the above plan for the public's acceptance generally state, more or less clearly, that the sums assured will be diminished or the premiums increased in the event of future bonuses falling below the estimated rate. This statement, however, is generally followed by one sufficiently emphasised to make it create a deep impression on the mind of the intending assurer under the scheme, to the effect that for many years past the bonuses of the office have equalled or exceeded that anticipated. Another statement usually follows to clinch and complete the impression thus made, which is to the effect that any bonus realised beyond the rate discounted will be added to the policy or applied to reduce the premium still further. While there is not the slightest intention on the part of the office to mislead, yet many policy-holders do not understand, or have not had sufficiently explained to them, the risk of the policies being reduced or the premiums increased in future years.

They think that they are getting a with-profit policy at without-profit rates, and would feel that an injustice were being done to them were it ever found necessary to put into force the powers conferred by this policy to which I have already referred. I don't say that all policy-holders are ignorant of the conditions of the contract into which they enter with a Life Office under this or any other scheme, but outside workers in the field of Life Assurance will, I think, bear me out in this from their own experience, that there is still, even in these days when the business is so keenly canvassed, a great and unaccountable amount of ignorance or indifference, or both, displayed in regard to the matter by assurers, and in many cases by men who in their ordinary daily avocations display a considerable amount of mental acumen and skill.

That there is need for the objection I have mentioned being taken into consideration, is shown by the reductions in the rates of bonus recently declared by many offices compared with those they had been able formerly to declare. As we have seen, the principal factors affecting bonuses are, (1) rate of interest realised on the funds, (2) expense incurred in obtaining and maintaining the business, (3) mortality experienced, and (4) profits from miscellaneous sources. In regard to the first factor, as will be seen from the table given earlier in this paper, the average rate of interest realised by British offices has fallen steadily during the last thirty years. This means a decline in bonuses. Whether the rate will continue to decline, or whether it will rise again, or whether, as some think, it has reached its lowest point, are matters which it is impossible to foretell. Turning to the matter of expenses, it has been found by investigation that the ratio of expenses to premium income of the principal British offices has increased in the past, and this increase does not seem likely to stop in growth if one is to judge by the ever-increasing difficulties of each office getting its share of new business, the indiscriminate allowing of commission, and the increasing frequency and amounts of special commissions allowed to agents who can influence business. This all means that a certain amount of the loading of the premiums reserved for profits is being eaten into, and consequently there will be less available supplies from this source in the future.

In regard to the matter of mortality, although that may have improved compared to what it was a generation ago, the adoption by an office to any considerable extent of a scheme of specially

low premiums may affect the mortality experience adversely as compared with those assuring at full with-profits rates of premium. It has been demonstrated time after time that the rate of mortality amongst assured lives bears a relationship to the rate of premium charged, the mortality being lighter where a high rate of premium is charged than that experienced where low rates of premium are paid. Especially is this noticeable in the case of endowment assurances.

As regards miscellaneous sources of profit, these are of too fluctuating a character to enable us to accurately gauge their result upon future prospects of bonus maintenance, but in regard to one important item which comes under this heading, viz., profit from non-participating assurances, the modern tendency to low-cut premiums for that class of business does not give much hope of increased profits from this source in the future.

Other disadvantages of the discounted bonus plan, looking at it this time from the office point of view, may be briefly mentioned. The premium income of an office transacting much business under this plan would be, for one thing, considerably reduced or kept at a lower figure than it would otherwise attain. Secondly, while the renewal commission expense might be lighter, the ratio to premium income would remain as before, while the fixed charges of office expenses, medical fee, policy stamps, &c., on new policies would tell heavier when set against the smaller premiums payable. Thirdly, there is the important question of the effect of lapses under this system. The increasing tendency to allow a policy to lapse after one or two years' duration is not a healthy sign in the modern competition for life business. In cases where a large introductory commission is paid, perhaps the whole, or nearly the whole, or it may be in some cases more than the whole, of the first year's premium is spent in expenses, when you include the medical fee, policy stamp, and office expenses. It does not pay an office, therefore, where a policy is allowed to lapse after the first or second year's premium has been paid, taking into account the risk run under the policy. This condition of things is aggravated under the discounted bonus plan, where the premiums are smaller than those received under the ordinary with-profit policies, and the initial charges of introductory commission, medical fee, &c., are the same, and the risk run is identical also. One way of counteracting this last-mentioned objection would be to reduce the rate of introductory commis-

sion payable for policies effected under the discounted bonus plan.

I now come to a consideration of the last two of the various methods of distribution of surplus, and because of their relationship with each other I have placed them in one group. I refer to the

Tontine Bonus and Deferred Bonus Systems.

In the case of the tontine bonus system, the profits are accumulated over a certain stated term of years and distributed among the survivors at the end of such term. In the case of the deferred bonus system, profits are not allocated until the premiums paid under a policy, accumulated at a certain compound rate of interest, amount to the sum assured. In some instances the allocation of bonus is contingent upon the expectation of life being survived.

It may be interesting to know that the name Tontine is derived from Tonti, an Italian, who, about the middle of the 17th century, established a fund under which those who joined it paid so much per annun on the condition that these payments with accumulated interest were to be divided amongst the survivors at the end of a certain term of years.

It will be observed that the two systems in their main idea are very similar, although they have each special characteristics which render them distinct the one from the other. In the case of the tontine bonus, or accumulation settlement system, as it has sometimes been called, the profits are allocated and distributed at the end of a certain fixed period of years, while in the case of the deferred bonus system the period which has to be survived before profits are obtained varies, in one instance, according to the amount of premium paid, and in another instance according to the age at entry.

The tontine bonus system has been principally pushed by the American offices doing business in this country, although several British offices have adopted the system for those whom they find prefer it to the ordinary methods. The premiums charged and the bonuses received under the system vary so much that it is not practicable to give a table of representative rates, and it is not desirable in a paper of this kind to specify any particular office.

In regard to the deferred bonus system, I find the rates at which premiums paid must accumulate to amount to the sum assured are 3½ and 4 per cent. Taking a representative rate of premium

at age 30 as £2 3s. per cent., it takes 26 years before such an annual premium accumulated at 4 per cent. compound interest amounts to the sum assured. In the case of the bonus being contingent upon the expectation of life being survived, this would mean, in the case of an assured entering at age 30, the completion of 35 years according to British Life Offices O^m Table, 1893, before any bonuses would be allotted under the policy.

The rates of premium charged by the offices granting deferred bonus policies are very little in excess of the ordinary non-profit rates for corresponding ages. The declared bonuses at a first allotment under these policies vary considerably, the results in one case varying according to the age at entry and corresponding accumulation period, and in another case a uniform amount being allotted, irrespective of age at entry and corresponding accumulation period, so that it is not practicable in this case either to give representative tables. The bonuses at subsequent distributions after the first are usually allotted according to the increase in the value of the policy since the previous distribution.

The chief merit or attraction of the above-mentioned systems lies, generally speaking, in the low rates of premium charged, with the chance of reaping a good bonus if the required period is survived. From the office point of view this should tend towards a good class of lives insuring under them, as those whose family record or feelings do not induce them to regard themselves as long-livers are not likely to insure under such schemes. This latter remark applies specially to the deferred bonus system.

The chief objection to the tontine bonus system is the fact that, in the event of the period not being survived, the assured forfeits all bonus benefit under the policy. Of course, he took the chance of that when assuring, and has no legitimate grievance, but it operates somewhat harshly in cases where the required period has all but been completed, when death steps in and makes the assurance non-participating. This objection applies also to the deferred bonus system, but only in a modified sense. The demerits, from the office point of view, are practically the same as I referred to in connection with the discounted bonus plan, in regard to the effect of fixed office expenses, medical fees, &c., telling heavier against the smaller premiums received, and the effect of lapses in the first year or two after assurance.

In concluding this discussion upon the various methods of

division of surplus, I think it will be admitted, on consideration of what has been said about them, that the one great fault of all the systems is their want of elasticity or ready conformity to the varying experiences of time and circumstance. They all depend, more or less, upon certain conditions existing, and, as in many instances the loading of the premiums or the methods of valuation have no consistent relation with the particular system of bonus distribution adopted, any material change in these conditions would render the latter inapplicable. Mr. T. E. Young, F.I.A., in his notes before referred to, states that as far as his consideration extended, no method of dividing surplus seemed capable of being devised which could confidently be anticipated to harmonise without some solution of continuity with the possible variations of business conditions in the future. Every plan must obviously be based upon the best obtainable compromise between theory and experience.

Although perhaps not quite within the scope of this paper, it may be interesting to note that the whole matter of bonus distribution originated with the old Equitable Life Office. In these early times (the old Equitable was founded in 1762) the premiums were based upon the only available table of mortality, the Northampton table, which, besides being imperfectly constructed, only represented the rates of mortality prevailing in two parishes, and these were found afterwards to have a much higher rate of mortality than that prevailing in the country generally. The consequence was that, in course of time, by judicious selection of lives the society found itself in possession of enormous funds accumulated out of favourable mortality experience, and they conceived the idea of returning the surplus of premiums paid to their policy-holders in the shape of bonuses. The system proved so popular that other offices were obliged to follow suit, and thus it has grown until the present time.

It is a question whether, in view of the number of varying systems in force at the present time, the trouble involved in maintaining them, and the frequent exaggeration and misrepresentation of future bonuses in many of the estimates that we see in the competition for business, it would not be better to revert to pure insurance, charging only sufficient premium to cover the risk run, with a margin for working expenses, and abolish bonuses altogether. With the scientifically constructed and reliable data now at our disposal, I do not see any obstacle in the way of such a desirable consummation.

THE FEDERATION OF INSURANCE INSTITUTES
OF GREAT BRITAIN AND IRELAND.

EXAMINATION PAPERS—1905.

FIRE BRANCH.

PART I., SUBJECT A.—POLICY DRAFTING AND ENDORSEMENTS.

(TANNERIES TARIFF.)

(*Two hours allowed for this Paper.*)

The use of the Tariff is permitted. Printed Warranties and Scale of Allowances must be used. The Scale of Allowances must be attached to the Drafts, but the Warranties, being uniform, must not be attached.

SURVEYOR'S REPORT.

Messrs. HYDE & SON, LIMITED, Riverside Tannery, BLANKHAMPTON.

Plan No.

1. Three storeys.—Ground Floor: offices (ordinary fireplaces), workpeople's entrance, and mess-room containing a securely-erected gas cooking stove; Second and Third Floors: warehouses for leather, and for drying same by atmospheric air only. Louvre-boarded windows to upper floors.
2. Four and five storeys.—Ground Floor: steam engine-house and machine-room for depilating, steeping, and fleshing (wet process); First Floor: workshop for finishing leather and for drying same by steam pipes; Second Floor: currying shop (dubbin warmed by steam) and leather-drying by steam pipes; Third and Fourth Floors: leather-drying by steam pipes and atmospheric air. Louvre-boarded windows to upper floors. Communicates with 3 by ordinary door, and with 4 by regulation double iron doors.
3. One storey.—Partly wood weather-boarded shed covering tan and lime pits. Communicates with 2 and 6 by ordinary doors.
4. Two storeys.—Ground Floor: boiler-house, containing one steam boiler securely set in brickwork and covered on top

Plan No.

with a layer of non-conducting composition two inches thick, and pump-house; Top Floor: drying-room for hide parings, having perforated iron floor. The drying is done by waste heat from boiler. Ground Floor communicates with No. 2 by double iron doors.

5. One storey.—Detached shed covering tan and lime pits with part timber partitioned-off, occupied as bark-grinding house, containing small steam engine and disintegrator for grinding bark.

6. One storey.—Enamelling house, containing two steam-heated enamelling stoves. Communicates with 3 by ordinary door.

Buildings all brick or stone built and slated, except as otherwise stated, lit by gas and heated and worked by steam, except where otherwise mentioned. No extinguishing appliances.

NOTE OF AMOUNTS SUPPLIED THE TARIFF INSURANCE COMPANY BY ITS AGENT.

	1.	2.	3.	4.	5.	6.	OPEN.	TOTAL.
	£	£	£	£	£	£	£	
Building . .	750	1,500	300	250	200	300	—	
Machinery . .	—	1,500	—	50	50	50	—	
Stock-in-trade .	2,000	3,000	—	50	50	250	—	
Steam Engines .	—	150	—	—	100	—	—	
Steam Boilers .	—	—	—	200	—	—	—	
Steam Pipes .	—	50	—	20	20	50	—	
Office Furniture .	250	—	—	—	—	—	—	
Liquor in Pits .	—	—	250	—	250	—	—	
Hides in Pits .	—	—	700	—	800	—	—	
Stock of Bark in open . .	—	—	—	—	—	—	360	
	£3,000	£6,200	£1,250	£570	£1,470	£650	£360	£13,500

Draft Policy, either schedule form or otherwise, from the accompanying report and note of amounts as supplied by agent. Calculate premium and mark rate against each item, showing how same is made up.

The specification wording need not be written out in full, but may be abbreviated thus:

On machinery, &c., as per item 2,

On stock, &c., as per item 3,

and so on. All references to averages must, however, be stated. From 25th March, 1905, to Ladyday, 1906.

FIRE BRANCH.

PART I., SUBJECT A.—POLICY DRAFTING AND ENDORSEMENTS.

(FLAX MILLS TARIFF—IRELAND.)

(*Two hours allowed for this Paper.*)

The use of the Tariff is permitted. Printed Warranties and Scale of Allowances must be used. The Scale of Allowances must be attached to the Draft, but Warranties, being uniform, must not be attached.

Prepare policy wording and premium for the following :—

"INVER MILLS," KIRCUBBIN, Co. DOWN, owned and occupied by John Leaske & Co., Flax Spinners and Linen Manufacturers.

No. 1. One storey.—Buildings, all communicating—gate office, workers' dining-room (well-secured pipe stove for cooking purposes), mill furnishing and bobbin stores; detached.

No. 2. One storey.—Dry spinning and twisting shed, hacklemakers' shop, yarn-bundling room; felt-roofed.

No. 3. Two storeys—*First*: Boiler-house and firing place, no drying, communicating with No. 2 by double F.P. doors only. *Second* (having an iron trellis floor): Yarn-drying. No. 3 is felt-roofed.

No. 4. One storey.—Weaving, winding, warping and reeling shed, part iron-built, communicating by double F.P. doors in P.P.W. with No. 2.

No. 5. Five storeys.—*First* (fireproof): Two non-communicating compartments, each having external entrance only—(*a*) engine-room, (*b*) carding-room. *Second* (fireproof): Wet spinning. *Third* (ordinary construction): Dry-spinning and hand-sorting. *Fourth* (ordinary construction): Twisting and breaking. *Fifth* (ordinary construction): Twine plaiting and balling. Second to fourth floors of No. 5 communicate through ordinary wooden doors with common external stone staircase, but there is an internal stone stair from fourth to fifth floors.

All buildings are brick or stone built and slated except as mentioned. Lighted throughout by approved electric arc lamps. No Tariff extra rates other than mentioned.

F.E.A.—Stationary fire-engine with hydrants attached, and five-gallon extincteurs to scale throughout.

communicates with ground floor of No. 3 by fireproof door.

4. *On Plan.* Stone and slated building of one storey, adjoining and communicating with No. 3 as aforesaid, occupied as steam engine and boiler-house.
Rate, 19/6.

Buildings which stand entirely detached are situated Castle Street, Kelso, known as the "INTERNATIONAL PRINTING WORKS," constructed as above described, lit by gas and protected throughout by approved Automatic Sprinklers (Grinnell), together with two hydrants in yard, and buckets according to rules—the Insurance to be subject to average—30% discount allowed off premium.

Draft wording for policy and calculate annual premium, showing rates, 25th March, 1905, to Midsummer, 1906. Amounts as follows:—

	No. 1.	No. 2.	No. 3.	No. 4.	Sundry Amounts.
On Building	1,500	2,500	4,000	100	—
,, Iron Gangways between 1 and 3	—	—	—	—	80
,, Stock	5,000	1,500	3,700	—	—
,, Furniture, &c.	300	200	350	10	—
,, Machinery, &c.	1,000	5,000	5,700	—	—
,, Piping	150	200	350	25	—
,, Electro-motors, &c. ...	—	150	—	—	—
,, Gas Engine	70	250	—	—	—
,, Steam Engine	—	—	—	350	—
,, Steam Boiler	—	—	—	230	—
,, Sprinkler Installation and Tank	—	—	—	—	850
,, Type, Lithographic Stones, Blocks, Patterns, Designs	750	2,775	1,125	—	—
	£8,770	£12,575	£15,225	£715	£930

Candidate will re-arrange divisions, amalgamating such amounts as he may deem proper.

A letter as follows is received from the Insured on 24th June, 1906:

"We have been making re-arrangements at our works and enclose Policy so that you may give effect to the following:—An annexe has been added to and communicates with No. 2 on plan, and the amounts on 2 are to cover this also. The stock in 2 will require increasing by £500, machinery by £700. To effect this, reduce stock in No. 1 by £500, and machinery in No. 1 by £100; reduce stock in No. 3 by £300, and machinery in No. 3 by £300."

Draft endorsement, showing alteration in future premium.

FIRE BRANCH.

PART I., SUBJECT B.—RE-INSURANCES.

(*One hour and a half allowed for this Paper.*)

QUESTIONS.

	Marks.
1. What is the broad moral principle which must form the basis and control the operations of all fire guarantee business?	20
2. Describe the various stages in transacting guarantee business up to the issue of the guarantee policy ..	25
3. What is the limit of time allowed the insuring office to furnish the guarantee offices with copy of specification, and what is the remedy of the guarantee office if that time-limit be exceeded?	20
4. Suppose a guaranteeing office were to write the insuring office as follows:—	

1st *December*, 1903.

G/....................Thomson.

"I regret to inform you that we shall be unable to continue the above guarantee upon its expiry at Christmas next."

What should the reply be?	20
5. What is a sub-guarantee?	20
6. What rule of procedure must be observed before a guaranteeing office can sub-guarantee?	20
7. What difference exists between the rules affecting a take note issued by a head office and one issued by a branch?	25
8. An insuring office A gives a guarantee to B. A fire takes place under circumstances which according to the conditions of A's policy would render A liable, but under the conditions of B's ordinary policy, B would not be liable. How can B evade its liability under its guarantee to A?	25
9. Describe the method of procedure laid down for the control of guarantee renewals as between insuring office and guarantee offices	25
Total of Marks ..	200

FIRE BRANCH.

Part I., Subject C.—GENERAL RULES FOR THE REGULATION OF FIRE INSURANCE BUSINESS.

(*Two hours allowed for this Paper.*)

Questions.

1. What openings in a party wall are not to be regarded as communications? (15 Marks.)
2. How are the cubical contents of buildings, fireproof and non-fireproof, to be computed? (25 Marks.)
3. How may an insurance on household goods in a private dwelling-house be extended? (20 Marks.)
4. What is the definition of a storey? (20 Marks.)
5. What is the maximum discount on the ordinary one year's premium which may be allowed on premiums paid in advance for three years, five years, and seven years respectively? (10 Marks.)
6. What is the effect of the marine clause? (20 Marks.)
7. What is meant by the term "fireproof compartment"? (15 Marks.)
8. Write in full (*a*) the *pro ratâ* condition of average; (*b*) the second condition of average. (25 Marks.)
9. Under what conditions is it permissible to extend an insurance in carriers' warehouses, under carriers' floating policies, the range of which is prescribed by Tariff? (20 Marks.)
10. Name the warranties which must be inserted on policies in all cases in which the insured can be held responsible; also state the regulations applicable to special cases. (30 Marks.)

FIRE BRANCH.

Part II., Subject A.—KNOWLEDGE OF TARIFFS.

(Tanneries.)

(*One hour and a half allowed for this Paper.*)

Questions.

		Marks.
1.	State what risks which would otherwise be rateable under the Tariff are especially excluded	15
2.	What is the minimum rate, after all deductions, for any risk rateable under the Tariff?	10
3	The Tariff enforces a charge of 2/6% for currying; state what process or processes come under this charge and	

Marks

what process or processes of the nature of currying is or are exempt 30

4. What are the Tariff extras—
   (*a*) For the drying or conditioning of skins by—
   (1) Heat from boiler—the boiler being covered by 5 or 6 inches of brickwork?
   (2) Steam pipes?
   (*b*) For the drying of wool—
   (1) By brick-built coke stove?
   (2) On perforated iron floor over boiler? 30
5. State the conditions laid down in connection with the following:—
   (*a*) Vegetable or lamp black;
   (*b*) Oily wipes and cloths for oiling or greasing leather;
   (*c*) Waste clippings, cuttings, and other refuse .. 30
6. State what difference in rating and conditions are made for "standard fire-resisting" buildings 20
7. In what respects do the Tariff provisions vary from the usual practice regarding adjoining and communicating buildings? 25
8. State the Tariff conditions and ratings for contents of tan and lime pits, and bark stocked in the open 20
9. Is it permissible to pay commission on insurances under this Tariff? If so, to whom? 10
10. Apart from the rates, warranties, and specification wordings, are any conditions prescribed in connection with insurances? 10

200

FIRE BRANCH.

Part II., Subject A.—KNOWLEDGE OF TARIFFS.

(Flax Mills—Ireland.)

(*Two hours allowed for this Paper.*)

Candidates are requested, in all cases, to show how rates are made up. Risks are to be regarded as normal unless as otherwise stated.

Candidates may answer either in accordance with

(1) The recently superseded Tariff dated April, 1904, or

(2) The revised one, dated 25th January, 1905;

but they must state definitely on the top of the answer paper upon which Tariff they elect to be judged, and must adhere throughout to the Tariff selected.

QUESTIONS.

Marks.

1. (*a*) Enumerate the processes rateable under the "Weaving, &c.," section of the Tariff 15
   (*b*) Under what circumstances are weavers exempted from the operation of the Tariff? 5
2. (*a*) Name the various "additional rates" for roughing done in ordinary compartment inside a mill • .. 15
   (*b*) How must a roughing shop adjoining and communicating with a mill be arranged so as to—
   (1) Reduce the "additional charge" on the mill by one half? 10
   also (2) Avoid any "additional charge" on the mill? 10
3. (*a*) State the rule as to the application of "additional rates" to shed mills 5
   (*b*) Particularise any exceptions to the rule 5
4. (*a*) Compute the net annual premium on the following—£5000 on the contents of a fireproof shed solely occupied for machine heckling; approved incandescent gas-lights, extinguishing appliance allowance 10%, building conforms to the rules for standard fire-resisting buildings 15
   (*b*) Mention if any particular clause be applicable .. 5
5. (*a*) What is the rate for a power-loom weaving factory with warping and reeling rooms over—part timber-built, oil lamps? 10
   (*b*) What rate would be chargeable if the risk became silent? 5
6. Write out the "machinery, &c.," wording in the schedule of specification 15
7. What normal rates are charged, respectively, for the drying of
   (*a*) Yarn? 10
   and (*b*) Hemp? 10
   in a drying-room over a boiler-house, the floor of former not being wholly incombustible;
   (*c*) Mention any "additional rates" to which either may be subject 10
8. (*a*) State the normal rate for a building occupied solely for wet spinning 5
   (*b*) Specify the "additional rates" and clauses to which the risk is subject 5
9. What are the rates for the building of a shed mill; defective construction; approved electric arc lamps; hand-sorting and carding done in ordinary compartment; jute used; automatic sprinklers, no ordinary appliances? 15

Marks.

10. Rate the following risk—
 Non-fireproof storeyed flax mill.
 Sheet-iron gable.
 Seven storeys in height.
 No opening through any floor, but each floor communicates by wooden door with common external brick and stone stair.
 Ordinary oil lamps throughout whole premises.
 Boiler inside in fireproof compartment, entrance protected by double F.P. doors. Yarn dried in room over boiler, intervening floor *not* wholly incombustible.
 Machine heckling done on ordinary floor of mill; carding done only in building adjoining mill, and communicating therewith by double F.P. doors (no opposing or overlooking windows or openings within ten feet).
 Dry spinning 30

200

FIRE BRANCH.

PART II., SUBJECT A.—KNOWLEDGE OF TARIFFS.

(SHOPS—ENGLAND AND WALES.)

(*Two hours allowed for this Paper.*)

QUESTIONS.

1. Mention the occupation to which this Tariff applies. (15 Marks.)
2. Define the term "premises" as used in Tariff. (15 Marks.)
3. What rate would you charge a cycle dealer (*a*) with and (*b*) without oils? Give the Warranties in full. (15 Marks.)
4 What rate would you charge a chemist and druggist (*a*) with and (*b*) without oils? Give the Warranties in full. (15 Marks.)
5. What rate would you charge a draper other than woollen, with one hundred assistants (ten of whom are employed in the restaurant or tea-room), and what extra would you charge if he also carried on the trade of a chemist and druggist? (20 Marks.)
6. A draper decides to carry a stock of house furnishings, domestic ironmongery, and hardware. State what extra rate is chargeable, and quote the Tariff on the point. (15 Marks.)

7. Large premises in which there are combined trades in one tenure communicate throughout. Insured desires to reduce the rate, but wishes to preserve a communication. What would you recommend? (20 Marks.)

8. In the case of a sprinklered building, state:
   (*a*) The discount for automatic sprinklers.
   (*b*) Does this include discount for ordinary fire appliances?
   (*c*) What is the minimum net rate?
   (*d*) To what items would the average clause apply? (30 Marks.)

9. What is the rule as regards payment of a fixed percentage for interest on pledges in a pawnbroker's shop in the event of fire? (15 Marks.)

10. What is the rule for goods in a strong-room, and define the term "strong-room"? (10 Marks.)

11. What discount may be allowed on standard fire-resisting buildings and on what conditions? Give the minimum net rate for such buildings. (15 Marks.)

12. Mention some combinations of trades which entail an additional rate of 2/6 %.

FIRE BRANCH.

Part II., Subject A.—KNOWLEDGE OF TARIFFS.

(Shops—Scotland.)

(*Two hours allowed for this Paper.*)

Questions.

1. To what risks does this Tariff apply? (15 Marks.)
2. How are a general merchant's premises rated? (10 Marks.)
3. Define the term "premises." (15 Marks.)
4. Under what circumstances is the insurance over a building rateable under this Tariff to be made subject to average? (15 Marks.)
5. Are the waitresses in a draper's tea-room to be included in the number of assistants? (10 Marks.)
6. What is the lowest rate chargeable under this Tariff for household furniture, exclusive of sprinklered risks? (15 Marks.)
7. What is the maximum rate for any risk rateable under this Tariff? (10 Marks.)
8. (*a*) What is the rate for goods in a strong-room?
   (*b*) Define the term "strong-room." (25 Marks.)
9. (*a*) What is the "contents" rate for an ironmonger's shop subject to Warranty B?

(*b*) What would be the rate without any warranty as to oils? (15 Marks.)

10. (*a*) What is the rate for the contents of a shop occupied by a draper (other than woollen) also carrying on in the same premises the business of a hardware and lamp dealer, employing 275 hands; Warranty B to be inserted? (20 Marks.)

(*b*) What would be the rate for contents were the building of "standard fire-resisting" construction and protected by automatic sprinklers; with no warranty as to oils inserted? (20 Marks.)

11. What are the "building" and "contents" rates for the following?—

(*a*) Ship chandler's premises with Warranty A applied; under 20 assistants.

(*b*) Cycle dealer's shop with Warranty B applied; under 20 assistants.

(*c*) Watchmaker and jeweller's shop; 25 assistants.

(*d*) Chemist's shop with Warranty D applied; under 20 assistants.

(*e*) Pawnbroker's premises; 30 assistants. (30 Marks.)

FIRE BRANCH.

PART II., SUBJECT A.—KNOWLEDGE OF TARIFFS.

(SHOPS—IRELAND.)

(*Two hours allowed for this Paper.*)

QUESTIONS.

1. To what premises does this Tariff apply? (15 Marks.)

2. What hands are included and excluded in the term "assistants"? (15 Marks.)

3. What is the governing feature as regards rating premises in plural tenure? (15 Marks.)

4. How is a pawnbroker dominated by the Tariff, and upon what terms? (15 Marks.)

5. How is a cycle dealer treated under the Tariff? (15 Marks.)

6. What is the rate for a grocer's shop (25 assistants employed) retailing mineral oil, but keeping the entire stock of such, amounting to 50 gallons, in a small store adjoining but not communicating otherwise than by double fireproof doors? (15 Marks.)

7. By what change of circumstances may a country furniture and hardware dealer paying 10/- reduce his rate to 7/6? (15 Marks.)

8. What is the difference in treatment of dressmakers under the different classifications of the Tariff? (15 Marks.)

9. Give the definition of " strong-room " and state the terms of insurance regarding same? (20 Marks.)

10. Upon what terms can an allowance be made for construction and fire-extinguishing appliances under this Tariff? (15 Marks.)

11. Define the word "premises" under this Tariff? (15 Marks.)

12. For what combination of trades is an additional half-crown chargeable? (15 Marks.)

13. A draper decides to carry a stock of house furnishings, domestic ironmongery, and hardware. State what extra rate is chargeable, and quote the Tariff on the point. (15 Marks.)

FIRE BRANCH.

PART II., SUBJECT B.—MANUFACTURES.

(LEATHER.)

(*One and a half hours allowed for this Paper.*)

QUESTIONS.

1. Name and briefly describe the different classes of pits usually found in tanneries. (10 Marks.)

2. Do you consider the contents of tannery pits essentially free from the risk of loss or damage by fire, or otherwise? Please state your reasons as fully as possible. (20 Marks.)

3. Describe briefly the processes involved in producing " sole " leather. (25 Marks.)

4. Generally speaking, would you say " high " or " low " temperatures were necessary in leather-drying rooms? Give any reasons in support that suggest themselves. How is the temperature of these rooms usually obtained? (25 Marks.)

5. What are timber louvres, and why are they so common in tanneries? (20 Marks.)

6. What is Valonia? Where is it obtained, and how and where is it used in the tannery? (10 Marks.)

7. What do you understand by the terms " green hide," " currying," " splitting," " filling," " scouring," " fleshing," " skiving," " waxing," " dubbin," " tanning "? (30 Marks.)

8. Name as many as you can of the processes carried on in tanneries by means of power other than manual. (30 Marks.)

9. State what you consider to be the main fire hazards of tanneries. (20 Marks.)

10. Which side of the leather is blacked in producing ordinary black boot uppers? (10 Marks.)

FIRE BRANCH.

Part II., Subject B.—MANUFACTURES.

(Paper.)

(Two hours allowed for this Paper.)

Questions.

1. What points would you keep in view in choosing a site for a paper mill? (15 Marks.)
2. How would you arrange the buildings to minimise the spread of fire? Sketch a small plan to illustrate your answer. (30 Marks.)
3. What is Cellulose? State also the principal paper-making materials which yield the largest percentage of Cellulose. (15 Marks.)
4. What treatment do the following raw materials get before entering the "breaker": (*a*) rags, (*b*) esparto, (*c*) straw, (*d*) wood pulp? (15 Marks.)
5. Do you consider there is any risk of fire from the preliminary rag machine, and if so, why? (15 Marks.)
6. Name the raw material most extensively used, and also the material you consider most likely to create fire when stored in bulk, and why. (15 Marks.)
7. State the difference between engine-sizing and tub-sizing. What is the object of sizing? (15 Marks.)
8. Is there anything in the process of size-making calling for particular attention as regards fire hazard, and if so, what? (15 Marks.)
9. Name the essential parts of a paper-making machine, and say how the pulp is treated on passing through it. (20 Marks.)
10. What departments should claim your particular attention as regards the artificial lighting? and say what type of lamp you would suggest for (*a*) gas, (*b*) electricity. (15 Marks.)
11. In which department would you expect to find the greatest deterioration of the gas and electric fittings and wires, and why? (15 Marks.)
12. Which class of paper mill would you consider the least desirable fire risk? Give reasons. (15 Marks.)

FIRE BRANCH.

PART II., SUBJECT C.—BUILDING CONSTRUCTION (INCLUDING HEATING).

(*Two hours allowed for this Paper.*)

QUESTIONS.

1. State what in your opinion are the best fire-resisting materials to be used in the construction of the walls of a building. Give briefly your reasons. (15 Marks.)

2. What special danger is there in exposed iron or steel work of so-called fireproof buildings, and how may it be obviated? (15 Marks.)

3. When beams or girders rest on bearing walls, it is desirable that the weight should be distributed so as not to press immediately on single bricks or stones. Suggest a method of effecting this. (15 Marks.)

4. What is the meaning of the terms "trimmer" and "trimming joist"? (15 Marks.)

5. Draw a plan showing the proper position of the floor timbers in trimming round a hearth, showing also the fireplace opening and flues. (20 Marks.)

6. Why is a well-hole through the floors of a building regarded as an undesirable feature of fire hazard? (10 Marks.)

7. State any particular fire hazard connected with a rope or strap race within a mill of which you may be aware. What in your opinion would be the best means of obviating such fire hazard? (15 Marks.)

8. Would you consider a staircase or a non-fireproof hoist inside a storeyed building as a hazardous feature? Give a reason for your opinion, and suggest the best positions for both. (10 Marks.)

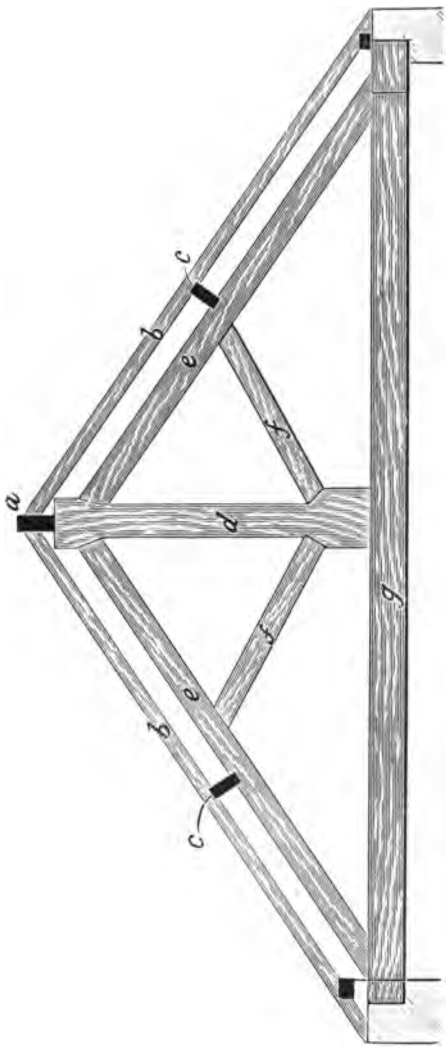
9. Why are parapet walls between adjoining buildings of similar height desirable? (10 Marks.)

10. Name the technical terms applied to the roof timbers shown on the sketch opposite, and lettered respectively *a*, *b*, *c*, *d*, *e*, *f*, *g*. (15 Marks.)

11. What is the most effective construction of a fireproof door? Mention any special points to be observed in fixing same, and in building the opening for such door. (15 Marks.)

12. Give a rough outline of (1) a hipped roof, and (2) a Mansard or curb roof. (15 Marks.)

13. In what comparative order of least fire hazard would you place the following three methods of heating shops and other small risks, viz., gas stoves, oil stoves, pipe stoves? Give briefly your reasons. (15 Marks.)



14. In what comparative order of least fire hazard would you place the following three systems of heating churches, schools, and other public buildings, viz., hot air, low-pressure hot water, and high-pressure hot water? Give briefly your reasons. (15 Marks.)

FIRE BRANCH.

PART II., SUBJECT D.—CORRESPONDENCE.

(*Two hours allowed for this Paper.*)

QUESTIONS.

1. An agent, A.B., intimates that owing to his removal to another part of the district, he is compelled to resign his agency, and asks that it be transferred to C.D., a suitable representative. Write appropriately to
   (*a*) A.B.
   (*b*) C.D.
   (*c*) The policy-holders of A.B.'s agency. (30 Marks.)
2. A small claim is received for damage to household effects, and on each item the Insured has claimed replacement value, although the articles were not new. Write to the Insured regarding the basis of settlement. (15 Marks.)
3. On the 20th October, a policy-holder intimates that he has removed his furniture from private house to a furniture store (5/- rate), and adds that the storage may possibly only be for a few weeks. The policy is renewable at Christmas. Write stating the course to be taken. (20 Marks.)
4. An agent intimates that an Insured has expressed a desire to have his insurance passed through his agency at renewal, instead of through the agency in which it was originally effected. Reply stating the steps to be taken. (20 Marks.)
5. A policy-holder writes on October 20th, stating that an insurance renewable at Ladyday is no longer required (the dwelling-house insured having been sold), and asks for rebate. Reply. (20 Marks.)
6. After payment of a loss, an Insured writes enquiring if the insurance can be re-instated. Reply stating how this may be done. (20 Marks.)
7. A firm intimate on the last of the days of grace that they wish to renew their insurance, but some slight alteration may be required when the result of their stock-taking is known—in a week's time. Reply advising the manner in which the insurance is to be kept in force. (20 Marks.)
8. Reply appropriately to the request of a firm of wholesale woollen merchants at Ladyday, 1905, for an additional insurance of £5000 on contents of their warehouse, the policy to date to Midsummer, 1905, so as to become renewable at the same time as their other policies. (25 Marks.)
9. Reply to a policy-holder having considerable insurance on farm buildings, agricultural produce, and live stock, who complains that no concession in premium is made to him, although his premises are fitted with electric light (dynamo driven by oil engine), and he has some efficient extinguishing appliances. (30 Marks.)

FIRE BRANCH.

Part II., Subject E.—PLAN DRAWING.

(*Two hours allowed for this Paper.*)

Instructions.

Draw to a scale of 40 feet to one inch.

The measurements given denote feet.

Buildings all of stone or brick unless otherwise described.

Doorways and openings are indicated thus **X**

Public and private hydrants marked thus ⊕

1. Corn mill, six floors, communicating by double metal covered doors with Nos. 2, 3, 8, and 24. There are windows on the 5th and 6th floors overlooking the roof of No. 2, those on 5th floor being within 10 feet of said roof; wall between 1 and 2 is 30 inches through roof.

2. Wheat cleaning, four floors.

3. Disused wind-mill, now a warehouse only; communicates with No. 24 on the east and south sides.

4. Smut and stive rooms, communicating with No. 2 by double metal covered doors. This building is the same height as No. 2, but the division wall goes 30 inches above the roof.

5. Wheat conditioning. Open to 4. Similar division wall as to No 4.

6. Grain washer.

7. Loading dock open to yard, roof supported by two metal columns.

8. Warehouse, two storeys, single iron door to No. 11.

9. Warehouse, two storeys, communicating with No. 3.

10. Gas and water meter house, communicating with No. 9.

11. Millwrights' shop.

12. Offices, communicating with No. 7.

13. Cart shed, open to yard, roof supported by five metal colunms.

14–15. Cottages.

16. Loose box. Wood partition to 17.

17-19. Stables.

18. Harness-room with men's dining-room over. A passage 5 feet wide goes through the centre of this building.

20. Timber fodder store.

21. Water softener—iron construction.

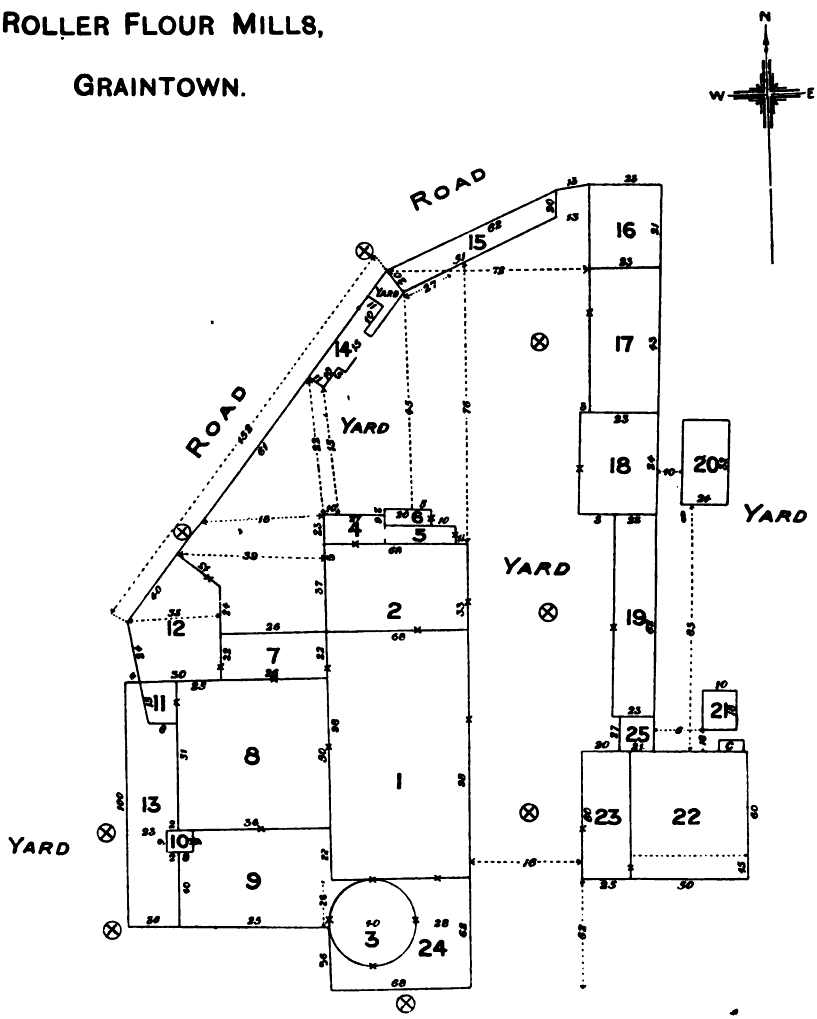
22. Boiler-house. Five boilers, each 40 feet long by 8 feet in diameter. The dotted line indicates firing end, and the other end is 5 feet from the north wall. The distance of the boilers next to the east and west walls is 2 feet in each case, and the intervening spaee between the others is equalised. The boiler-house is open

to yard at the south end, the roof being supported by three brick pillars of equal distance apart. The brick chimney, 10 feet square, is outside the building No. 22 at the north-east corner marked "C."

23. Engine-house. Single iron door to 22.
24. Warehouse. One storey, timber-built.
25. Lumber shed, open to west yard.

ROLLER FLOUR MILLS,

GRAINTOWN.



FIRE BRANCH.

PART III., SUBJECT A.—LAW OF FIRE INSURANCE AND FIRE INSURANCE CONTRACTS.

(*Two hours and a half allowed for this Paper.*)

QUESTIONS.

		Marks.
1.	Summarise concisely what constitutes insurable interest	10
2.	In the case of three persons, say brothers, separately and independently owning a house each (the three houses adjoining each other) would you object to grant a policy in the combined names, and if so, why? ..	20
3.	Is a remainder-man, or heir-at-law, entitled to insure his expected interest, and if so, what conditions should be attached to the policy?	20
4.	Explain the operation of a "garnishee order," and say what receipt you would require from the insured. ..	20
5.	In adjusting a claim for rent (under a tenant's policy) upon what points would you require to be satisfied?	20
6.	Define what is meant by the term "market value immediately before the fire"	10
7.	A cottage insured for £300 adjoins a large warehouse for storing Manchester goods; during the course of a fire at the latter, the gable collapses, demolishing the cottage, but no damage by actual fire has been done thereto. State your opinion as to the liability of the Company insuring the cottage, and your reasons ..	20
8.	Under what circumstances do you consider it advisable to have a statutory declaration?	10
9.	In the event of a Company's Assessor failing to arrange a claim, and the Company is served with a writ instituting an action at law, what procedure do you recommend?	20
10.	Under what circumstances is an Office liable for damage by explosion?	10
11.	What two cases are usually relied upon as proof of non-liability for damage by mere explosion, and what are the salient features of each?	20
12.	Define the following terms:— Arson, bailee, mortgagor, novation, subrogation ..	20
		200

FIRE BRANCH.

PART III., SUBJECT B.—AVERAGE CLAUSES AND LOSS APPORTIONMENTS.

(*Three hours allowed for this Paper.*)

The value of each question is the same. Whilst all questions may be attempted, candidates are reminded that good answers evidencing practical knowledge to a few questions are of more value than inferior answers to many.

QUESTIONS.

1. Give a brief but clear statement of the reason for the adoption of the Average Clause in Mercantile and Industrial Insurance.

2. Apportion the following loss, and give your reasons for the plan that you adopt:—

A fire occurs in a block of three warehouses all communicating, A, B, C.

AMOUNT INSURED.

Goods in A	for X, £1,000	...	£1,500 loss in	A.	
,, A, B, C	,, Y, 2,000	...	500 ,,	A.	(No goods in B.C.)
,, A.	,, Z, 1,000	...	2,000 ,,	A.	
,, C.	,, Z, 1,500	...	500 ,,	C.	

3. How would you apportion the above loss if the proprietors of the warehouses had specific insurances on goods in trust as warehouse-keepers—

For £5,000 in A.
7,000 ,, B.
6,000 ,, C.
5,000 ,, A, B, C—subject to average.

pro rata condition. No other goods in warehouse.

4. How would you apportion the loss if the £5000 in A, B, C were subject to the two conditions of average?

5. A fire occurs in a warehouse rated under the Wool Warehouse Tariff. There are the following insurances:—

Building...	£5,000	in office P.
Stock	5,000	for C. D. & Co., in office Q.
Electric motors in trust	500	,, ,, ,, R.
Stock	4,000	,, E. F. & Co., equal sums in offices S. & T.
,, ...	500	,, H. & Co., sent to E. F. & Co., in office P.
,, ...	500	,, L. & Co., sent to be made up by E. F. & Co., in office W.

NOTE.—E. F. & Co. are makers-up and packers.

Damage to Building	.. ..	£2,000.
C. D. & Co.'s Stock	..	3,000.
Electric Motors	..	600.

Damage to goods in packers' hands (E. F. & Co.) £4,500.

Apportion the loss.

6. Three buildings A, B, C, adjoin.

A, insured for	£4,000		office F.
B, „	2,000	building,	„ G.
	1,000	contents,	„ H.
	1,000	building,	„ F.
C, „	1,000	„	„ K.
	500	contents,	„ K.

A fire occurs in A. The wall falls and smashes-in the roof of B, doing damage to the extent of £1000. No fire occurs in B, but water damage is done to the extent of £500 on contents of B. The weight of material thrown upon B forces out the party wall of C, and lets the roof down at one end; damage to building C £700, contents £100.

Discuss the several liabilities of the Offices interested, taking into account the suggestion that the falling of the wall is due to the negligence of the owner of A, or delay of the assessor in dealing with it, and the contention that the owner or the assessor could not take steps to prevent it.

FIRE BRANCH.

PART III., SUBJECT C.—FIRE EXTINGUISHMENT AND SPRINKLER INSTALLATIONS.

(*Three hours allowed for this Paper.*)

QUESTIONS.

Marks.

FIRE APPLIANCES (ORDINARY SCALE):

1. What power of a manual fire engine (with trained fire brigade) is required to obtain 5% discount for appliances under the ordinary scale? 5
2. State the number of portable chemical extincteurs of two-gallon water capacity which would be required for a shed of one storey to entitle a firm to an allowance of 5%, assuming 1250 superficial square yards was the area of the floor.. 5
3. State the internal diameter of mains and hose which it is necessary to have in the case of new installations .. 5

Marks

4. Buckets or cans.—How many of these are required in order to obtain 5% discount? and state also the superficial floor area under which this allowance is made 5

AUTOMATIC SPRINKLER INSTALLATIONS:

5. State in connection with an installation of automatic sprinklers, what buildings are required to be protected in order to conform to the rules of the Fire Offices Committee 10
6. Give an instance where a sprinklered building communicates with a building which latter is not required to be protected in all its parts, and state the measure of protection required 10

SPRINKLER HEADS:

7. Give the names of six sprinkler heads which are now approved by the Fire Offices Committee 5

SPACING OF SPRINKLERS:

8. (*a*) Give the distance sprinkler heads must be apart as a general rule.
   (*b*) Also give distance in corn mills 5
9. (*a*) What is the maximum distance as a general rule sprinkler heads must be fixed from walls and heavy ceiling beams?
   (*b*) Also give same for corn mills 5

WATER SUPPLIES:

10. What are the accepted sources of supply? 5
11. Give an instance where the town's water cannot be accepted as one of the sources of supply 5
12. How many sprinklers may be fitted on any one row of distributing pipes? and also state how many sprinklers may be fixed on either side of the pipe feeding the distributing pipe previously named 5

ELEVATED TANKS, &c.:

13. How many gallons of water must a tank be capable of holding to supply, according to sprinkler rules, an installation of 175 sprinklers on any one floor, or on the corresponding floors of communicating buildings? 5
14. In the case of water from a tank being used for other purposes than that of supplying sprinklers, state under what circumstances this can be allowed 5
15. (*a*) How many gallons (approximately) are there in one cubic foot of water?
    (*b*) Give the cubical capacity, in feet, of a tank to hold 5000 gallons of water 10

Marks.

16. (*a*) What is the minimum distance between the base of tank and the highest sprinkler which is permitted by the sprinkler rules?
    (*b*) State what is the pressure per square inch of a column of water one foot in height.
    (*c*) What is the height of a column of water which would yield a pressure of one pound to the square inch?
    (*d*) What pressure of water can be obtained from a tank which has been fixed the minimum distance allowed between the base of tank and highest sprinkler? 20

PRESSURE TANKS:

17. (*a*) When a pressure tank is provided, state the minimum capacity of same (in gallons).
    (*b*) To what extent must this tank be filled with water?
    (*c*) What is the initial pressure that is required for the highest sprinkler, when the tank is on a level with it?
    (*d*) In cases where the pressure tank is on a lower level, what is the further air pressure required? .. 20

TOWN'S WATER:

18. What pressure (approximately) would be required at the ground level, to supply sprinklers in a building seventy feet high, so as to comply with the minimum pressure required by the sprinkler rules? 10

PUMPS:

19. (*a*) What quantity of water must a pump deliver per minute for the efficient supply of a sprinkler installation of 175 sprinklers on any one floor?
    (*b*) In estimating the capacity of a pump, state the speed in feet the plunger may be run in accordance with the regulations laid down in the sprinkler rules.
    (*c*) State what is the displacement in gallons of water per foot of piston travel in the case of a cylinder six inches in diameter 15
20. State the approximate theoretical discharge of water, in gallons, from a quadruple-acting pump having eight-inch diameter water piston, twelve-inch stroke, and running at a speed of fifty yards a minute for each piston 25

HYDRAULIC INJECTOR APPARATUS:

21. (*a*) What must be the quantity of water, in gallons, delivered per minute from this apparatus in a case where there are 190 sprinklers on any one floor?

Marks.

(*b*) What is the constant pressure per square inch that is required in the hydraulic main connected with the injector apparatus? 5

PRESSURE GAUGES TO INSTALLATIONS:

22. (*a*) How many gauges are required to an installation in which town's water forms one of the supplies?
(*b*) Name the position of each gauge 5

VALVES:

23. (*a*) State the position in which the main stop valve must be fixed in connection with an installation.
(*b*) In the sprinkler rules it is stipulated that all water supplies must be connected before passing through the main stop valve; state the exception where the joining-up of another supply at a point most readily available in the installation is permissible.
(*c*) Also state where subsidiary stop valves are allowed 10

FIRE BRANCH.

PART III., SUBJECT D.—ELECTRICITY.

(*Two hours and a half allowed for this Paper.*)

QUESTIONS.

1. Describe the method recommended for wiring an electrical storage battery room 10
2. What are the chief points to be observed in the inspection of an installation of wiring in a private residence? .. 10
3. Continuous current supply is brought on to premises by three conductors from a general supply system, the maximun pressure between any two of these conductors being 250 volts. Describe the safest method of distributing the current. Are there any other methods which would be more economical? 15
4. (*a*) Should fuses be placed in the neutral conductor of a three-wire system? Give reasons.
(*b*) Why should switches on the three conductors of a three-wire system be linked together? 15
5. Are there any conditions under which the bunching of conductors is advisable? If so, what are they? .. 10
6. Describe the respective merits of the following systems for distributing electrical energy;
(*a*) By aerial conductors (insulated).
(*b*) By conductors run in wood casings.
(*c*) By conductors run in metal tubes 20

	Marks.
7. Describe the precautions to be observed in carrying out work by each of the three systems mentioned in question 6	20
8. What special risks are incurred when bare (uninsulated) conductors are run in the ordinary method on bobbin insulators supplying energy to a travelling crane? How can these risks be minimised?	10
9. What are the relative merits of the utilisation of electrical, gas, and steam power in a sawmill?	10
10. A four-storeyed house is wired for electric light on a 3 ampere circuit system from distributing boards, each fed independently from the main switchboard, there being one distributing board on each floor. On the ground floor there are thirty-five lights, on the first floor twenty-five lights, on the second floor fifteen, and third floor ten lights. The pressure of the supply is 200 volts. Assuming that all the lamps are sixty watt lamps, what current would flow, when all the lamps are alight, through the following wires: (*a*) The main house service? (*b*) The branch wires feeding the second floor?..	10
11. State the points to be observed in the examination of the construction and fixing of impedence or resistance coils	10
12. Give the gauge, number of strands, and sectional area of conductors suitable for supplying energy to 1, 10, 25, 50, 100, and 300 lamps, each of sixty watts at 200 volts. State the current density which you have allowed ..	20
13. Describe the apparatus (switches, fuses, &c.) required for the protection of a motor installation, and state the protective uses of each piece of the apparatus ..	15
14. (*a*) Describe generally the fire risks in an electric generating station, stating where the greatest risk of fire usually occurs. (*b*) Describe the precautions to be taken in the arrangement of switchboards in electric generating stations	25
	200

FIRE BRANCH.

PART III., SUBJECT E.—CHEMISTRY.

(*Three hours allowed for this Paper.*)

The value of each question is the same. Whilst all the questions may be attempted, candidates are reminded that good answers evidencing practical knowledge to a few questions are of more value than inferior answers to many.

QUESTIONS.

1. Describe the synthetical methods of preparing hydrocyanic acid.
2. Explain what is meant by fermentation, and give examples.
3. Name the circumstances under which the following substances may become dangerous, either in storage or where mixed with other substances. (You need not deal with more than three of these.)
   Glacial acetic acid.
   Bronze powders.
   Oxides of lead.
   Oxides of sodium.
   Picric acid.
   Chromates.
   Chlorates
4. Describe any method of making artificial textile fibres that may be known to you, and point out its fire hazards.
5. Name the sources of fire hazard in the dyeing of cotton and/or wool with aniline black, Turkey red, and silk with bright yellows.
6. Name four chemicals in extensive use that are likely to cause organic substance to ignite or explode, and give short details as regards two of them.
7. Give a short account of the chemistry of oils, so far as relates to fire insurance.

ACCIDENT BRANCH.

PART I., SUBJECT—CORRESPONDENCE.

(*One hour and a half allowed for this Paper.*)

Marks.

A personal accident policy-holder described on his policy as farmer, master, superintending and occasionally working, meets with an accident, which, according to his doctor's report, does not confine him to bed, bedroom, or house. The Assured claims to be totally disabled. Write a letter to him, stating that only the partial disablement allowance can be granted him 30

A personal accident proposal is sent you by a good agent, with a statement to the effect that the renewal of proposer's policy has been refused by an Office on account of their unfavourable claim experience of the particular case; that nevertheless he strongly recommends the proposal, and that if you will accept it, it will be the means of introducing a number of other cases. After enquiry you decide against taking the risk. Write the agent declining the proposal .. 35

Marks.

Your experience of a certain trade over several years has been unfavourable, and you decide to raise the rates for that trade. Write the necessary letter to an Assured who has made no claim, on his policy becoming renewable 35

A personal accident policy-holder writes that he does not intend to renew his policy, as he has been insured ten years and has not received any benefit from it. Draft a suitable reply 35

An agent intentionally deducts commission from the gross personal accident premium in his account, instead of on the net premium, *i.e.*, the gross premium less bonus. Write to the effect that commission can only be allowed on the net premium.. 30

You have refused a claim on good grounds; your agent writes complaining that an agent of a rival Company is making unfair use of this fact, alleging that your Company always raises difficulties over its claims, and that in consequence of this he is losing business. Reply to your agent.. 35

200

ACCIDENT BRANCH.

Part I., Subject—CLASSIFICATION OF RISKS

(Personal Accident).

(*Three-quarters of an hour allowed for this Paper.*)

Questions.

State what general principles you would lay down for dividing occupations into three classes for personal accident insurance 30

Assuming proposers described themselves as undermentioned, what further information (if any) would you ask for before classifying the risks:—Master baker, licensed victualler, farmer, builder, accountant, cattle salesman? .. 30

Give reasons why most Accident Companies refuse to grant personal accident policies to jockeys, steeple-jacks, divers, coal miners, quarrymen, experimenting chemists, &c., &c., even though the persons engaged in such occupations be willing to pay a higher premium than that charged Class III. risks .. 40

100

ACCIDENT BRANCH.

Part I., Subject—KNOWLEDGE OF EMPLOYERS' LIABILITY.

(*One hour and a half allowed for this Paper.*)

Questions.

Marks.

1. (*a*) Under the E.L., 1880, Act, a workman is defined as "a railway servant, and any person to whom the Employers Workmen Act, 1875, applies." What is the definition of workman given by the last-named Act?
   (*b*) What is the definition of a workman given by the 1897 Act? 35
2. Within what time must notice of an accident be given to entitle the claimant to compensation:
   (*a*) Under the E.L. Act, 1880?
   (*b*) Under the Workmen's Compensation Act, 1897? .. 30
3. What particular circumstances must be present in any particular job to bring a builder under the Act of 1897? 35
4. What is the largest sum that a workman or his representatives can recover under the E.L., 1880, Act:
   (*a*) In case of death?
   (*b*) In case of disablement? 35
5. What difference in the scope of the 1897 Act was caused by the passing of the Factory Act, 1901? 40
6. Define the expression "agriculture" as used in the Workmen's Compensation Act, 1900 25

200

ACCIDENT BRANCH.

Part II., Subject—CLAIMS AND THEIR SETTLEMENT.

(*Two hours allowed for this Paper.*)

Questions.

Personal Accident:

1. What is required to bring an accident or bodily injury under the provisions of an ordinary accident policy? 20
2. What description of accidents or their effects are usually excluded from those covered by the policy? 15

Marks.

3. A policy-holder, who is described in his proposal and policy as a farmer, master, superintending only, met with an accident while unyoking his horse in the absence of the stableman. He makes a claim for disablement. How would you deal with this? .. 20
4. On a policy-holder making a claim for an accident, it is ascertained he has been insured with another Company, that he has received compensation for injury, and had omitted by alleged forgetfulness to disclose these facts in the proposal form. How would you deal with the claim? 25

EMPLOYERS' LIABILITY ACT, 1880:

1. A workman sustained an accident by the falling of a wall which was being undermined in the course of operations. What would be the probable grounds of claim against his employer? 20
2. A workman is injured in the course of employment by the fault of a fellow-workman, there being no blame attachable to the employer. Has the injured workman a claim upon his employer? 25
3. A workman undertakes a dangerous piece of work, and is injured while at work. Has he a claim upon his employer? Give reasons 25

WORKMEN'S COMPENSATION ACT, 1897:

1. To what extent is compensation allowed under this Act for (1) fatal accidents; (2) permanent total disablement; (3) permanent partial disablement; and (4) temporary partial disablement. In the case of permanent total and permanent partial disablement claims, by what method would you ascertain the amount for which they should be commuted? 30
2. An employer having intimated an accident to a workman, states that he keeps no wages book although the wages of the injured man were included in his estimate for the year. How would you deal with the claim? 20

200

ACCIDENT BRANCH.

PART II., SUBJECT—POLICY DRAFTING.

(*One hour allowed for this Paper.*)

1. Give the narrative clause of a personal accident policy insuring a colliery owner, master, superintending .. 25
2. It is desired to exclude pit risks from the above. Draw an endorsement to this effect 50

	Marks.
3. A solicitor declares in his proposal for insurance against personal accident that he has lost the sight of his right eye. Draw an endorsement to protect the Company in the event of injury to his remaining eye	65
4. An employer whose trade does not come under the Workmen's Compensation Act desires to give his men the benefit of the Act. Draw an endorsement to that effect	60
	200

ACCIDENT BRANCH.

PART II., SUBJECT—INDEMNITY (Third Party).

(One hour and a half allowed for this Paper.)

QUESTIONS.

CORRESPONDENCE:

1. Write a letter to an agent explaining the general scope of Third Party Insurance	40
2. A builder desires to take out a Third Party Policy to cover his outside risks. What information would you require from him?	30

CLAIMS:

3. A firm of wharfingers intimate a claim upon them by a member of the public who has been injured by a bag of flour being raised by a hoist. What would the injured person require to show to make the assured liable in damages?	35

SETTLEMENT:

4. A tramway car misses the points at a junction and several of the passengers are injured. The occupations are grocer, solicitor, labourer, and clerk. How would you settle the claim, distinguishing between those who were severely injured and those who were only slightly hurt?	40

LEGAL ASPECTS:

5. Is it necessary in all cases to prove fault on the part of the assured (or his employees) who holds a Third Party Policy, before a claim can be substantiated against the assured?	25
6. Under what circumstances would it be expedient to compromise a claim by a Third Party upon the assured?	30
	200

ACCIDENT BRANCH.

PART II., SUBJECT—MEDICAL AND SURGICAL TERMS.

(One hour allowed for this Paper.)

QUESTIONS.

	Marks.
1. Explain the following:	
(*a*) Synovitis of the knee-joint.	
(*b*) Fracture of the right fore-arm.	
(*c*) Fracture of the pelvis	60
2. What are meant by the following:	
Fibula?	
Tibia?	
Clavicle?	
Phyma?	
Phalanges?	25
3. Explain in your own language the terms Phlebitis, Appendicitis, Pyæmia	50
4. Give the names of the bones found in the leg from the ankle to the thigh	65
	200

ACCIDENT BRANCH.

PART III., SUBJECT—LAW: "THE RELATIONSHIP BETWEEN EMPLOYER AND EMPLOYED."

(Two hours allowed for this Paper.)

FATAL ACCIDENTS ACT, 1846.

1. What was the occasion of the passing of this Act?
2. What besides wrongful act may be stated as ground for claim?
3. Mention the relations for whose benefit action under this Act could be maintained.
4. Within what time must an action be brought under this Act?

REGULATIONS OF RAILWAYS ACT, 1875.

1. Mention the chief items in the Return to the Board of Trade provided by this Act.
2. What penalty is incurred in case of default? Has the Board of Trade power to dispense with Return, and in what circumstances?
3. What safeguard to the public is obtained by this Act and how does this operate?

Factory and Workshops Act, 1901.

1. What are the main provisions of this Act with regard to (1) health, (2) safety, and (3) accidents?

2. What restrictions are placed on the period of employment of women, young persons, and children?

3. What obligations rest on the employer in dangerous and unhealthy industries, and what regulations are provided?

Employers' Liability Act, 1880.

1. What allegations must be made against the employer to found an action for compensation under this Act?

2. What exceptions to these are stated by the Act?

3. What are the limits of sum recoverable as compensation?

4. Within what time must notice be given of injury and proceedings taken?

Coal Mines Regulations Act, 1887.

1. What are the qualifications required (1) manager of mine, (2) inspectors of mines?

2. Who are disqualified from acting in such capacities?

3. State briefly the general rules to be observed by mine owners for health and protection of workmen.

Quarries Act, 1894.

1. To what places does this Act apply?

2. Can inspectors under the Mines Regulation Act be inspectors of quarries?

Light Railway Act, 1897.

1. To whom must application for order authorising light railway be made?

2. In the event of injury to workmen engaged constructing light railway, would the provisions of the Workmen's Compensation Act, 1897, apply, and if so, why?

Workmen's Compensation Acts, 1897 and 1900.

1. What was the main benefit to workmen given by this Act as compared with their previous rights?

2. What is the provision as to notice of injury, and under what circumstances have the courts dispensed with the necessity for written notice?

3. What are the main employments to which this Act applies?

4. What is meant by the expression "Undertaker" in this Act?

5. Give instances of what has been decided as serious and wilful misconduct.

ACCIDENT BRANCH.

PART III., SUBJECT—EMPLOYERS' LIABILITY.

(CONTINENTAL.)

(*One hour and a half allowed for this Paper.*)

1. Give particulars of the German Accident Insurance Law of 1884 and the subsequent extending and amending Acts, mentioning specially:
   (1) To what trades and persons the Acts apply,
   (2) The Compensation payable thereunder,
   (3) The method adopted for raising the necessary funds,
   (4) Method of dealing with claims.
2. Give a similar outline of the Austrian Accident Law of 1887, &c., calling particular attention to these points where the provisions of the two countries differ.
3. State the Compensation provided by the French Act of 1898.
4. In regard to the following countries, state whether insurance by the Employer is compulsory or not, and if compulsory, with whom must the insurance be effected, and mention any special regulation providing for the solvency of such assurers.
   (1) Holland,
   (2) France,
   (3) Italy,
   (4) Norway,
   (5) Switzerland,
   (6) Denmark,
   (7) Spain.
5. State generally in what way the Italian Act of 1898 endeavours to provide for the liquidating of permanent partial disablement claims.
6. Specify the chief data tabulated in the Accident statistics issued by the Austrian Insurance Department.

ACCIDENT BRANCH.

PART III., SUBJECT—"LAW RELATING TO ACCIDENT INSURANCE."

(*One and a half hours allowed for this Paper.*)

1. In the case of an assured suffering from the effects of a fit falling on a railway line and being killed, what would be considered the cause of death, and would he be able to recover from the Insurance Company under an Accident policy?

6. Should a loan be granted to a policy-holder on security of his policy if he has lost it? Should a surrender value be granted? What is the procedure in such a case when the policy becomes a claim?

7. A policy-holder who has been insured for some years wishes to surrender. He points out that since his Insurance has involved no loss to the Office he considers he should get a return of at least all the premiums paid, since the Office has had the benefit of the interest on the premiums. Draft a reply.

8. An agent has been so frequently in arrear in the rendering and payment of his accounts that the Office has decided to collect the premiums in his agency direct, crediting him with the commission. Draft a letter telling him of the Office's decision, and one to the policy-holders in his agency informing them of the new arrangement.

LIFE BRANCH.

Part II., Section B.—BONUS SYSTEMS.

METHOD OF CALCULATING EXPENSE RATIOS.

(*Two hours allowed for this Paper.*)

Questions.

1. Explain fully any three bonus systems, and the advantages and disadvantages of each.

2. A Policy is to be effected this year (April, 1905) in an Office which divides its surplus quinquennially, the next investigation taking place in December, 1908. On the basis of a compound bonus of 30s. per cent. per annum for each premium paid, with an intermediate addition of 25s. per cent., state what the amount payable would be in the event of death in November, 1915.

3. What are the sources of profit in a Life Assurance Society? How are each of these sources affected by a decrease in the valuation rate of interest?

4. What reasons can you give for an Office valuing its liabilities at 2½ per cent. interest when it is making 4 per cent. on its funds?

5. State three methods of comparing expense ratios of different Offices, and the advantages and disadvantages of each.

6. What is the fallacy involved in a comparison between Offices showing the ratio of the premium income to the expenses and claims combined?

NAMES OF SUCCESSFUL CANDIDATES—1905.

The following is the Official List of the Successful Candidates at the Examinations held simultaneously at the various Insurance centres, April 10th to 20th, 1905. The letter "P" opposite a name signifies Pass, "H" Honours, and "C" Certificate accepted, to 31st May, 1905.

FIRE BRANCH.

	PART I.									PART II.									PART III.					
	Policy Drafting.									Tariffs.			Processes.											
	Tanneries.	Flax Mills (Ireland).	Printing Works.	Re-insurances.	General Rules.	Book-keeping.	Chemistry.	Electricity.	Passed in Part I.	Tanneries.	Flax Mills (Ireland).	Shops.	Leather.	Paper.	Building Construction.	Correspondence.	Plan Drawing.	Passed in Part II.	Law of Fire Insurance.	Avge. Clauses and Loss Apportnmts.	Fire Extinguishment.	Electricity.	Chemistry.	Passed in Part III.
BELFAST.																								
Hill, S. G., *Royal*	H	H	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
BIRMINGHAM.																								
Burrow, G. W., *Sun* ...	P	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Charlwood, E. C. H., *Guardian*	P	...	...	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chaundy, J. F., *Patriotic* ...	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1905—*continued.*

	Part I.									Part II.									Part III.					
	Policy Drafting.									Tariffs.			Processes.											
	Tanneries.	Flax Mills (Ireland).	Printing Works.	Re-insurances.	General Rules.	Book-keeping.	Chemistry.	Electricity.	Passed in Part I.	Tanneries.	Flax Mills (Ireland).	Shops.	Leather.	Paper.	Building Construction.	Correspondence.	Plan Drawing.	Passed in Part II.	Law of Fire Insurance.	Avge. Clauses and Loss Apportnmts.	Fire Extinguishment.	Electricity.	Chemistry.	Passed in Part III.
Birmingham—*continued.*																								
Davies, G. E., *Alliance* ...	H	H	H	H	H	C	...	C	...	...	...	..	...	...	...	...	...	..	...	...	...	...	...	...
Holland, G. P., *Royal Exchange*	P	...	...	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Jones, A. H., *Royal Exchange*	P	...	P	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
McRobert, J. H., *Alliance* ..	...	..	...	...	...	...	...	...	...	P	...	H	H	H	H	...	...	..	...	...	...	...	...	...
Plummer, N. C., *Northern* ...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...
Robison, W. A., *Royal* ...	P	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Skempton, L., *Royal* ...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sparshott, H. L., *Scottish Union and National*	...	...	...	...	...	C	...	...	...	H	...	H	P	...	...	P	...	...	...	...	...	...	...	...
Stocks, E. A., *Westminster* ...	P	...	...	...	...	...	...	...	...	H	P	H	P	P	...	H	...	...	...	...	...	...	...	...
Turner, H. E., *Scottish Union and National*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	P	1905

Wheeldon, O., *Caledonian* ..	...	...	...	...	...	...	...	...	...	...	...	...	P	...	H	P	P	...	...	...	...	...	...	...
Wright, S. C., *Royal Exchange*	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
BRISTOL.																								
Davis, M. J. L., *Royal Exchange*	...	...	P	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gane, C. E., *Alliance* ..	...	...	...	...	...	...	...	...	...	H	...	H	H	H	...	P	P	...	...	...	...	...	...	...
Griffiths, D., *Alliance* ...	...	...	...	...	...	...	...	...	1905	H	...	...	P	H	P	...	...	1905	...	P	H	P	...	...
Kepple, R. H. J., *Sun Fire*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	H	H	...	...	...
A. H. Lucas, *Hand-in-Hand*	P	...	...	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mason, R., *London and Lancashire*	...	...	...	...	...	...	...	...	...	...	...	H	P	...	...	...	...	...	...	...	...	...	...	...
Osmond, C., *Atlas*	P	...	H	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Phillipps, J. R., *Norwich Union*	H	...	...	...	...	...	...	...	...	H	...	H	H	P	...	P	P	...	...	...	...	...	...	...
Poole, W. H., *Northern* ...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	P	...	1905	H	...	...	...	...	...
Shellard, H. M. T., *Hand-in-Hand*	P	P	...	P	P	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	..	...
Simpkin, H., *Royal Exchange*	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Waltham, W. H., *Alliance* ...	...	...	...	P	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Williams, F., *Norwich Union*	P	...	...	H	P	C	..	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1905—*continued.*

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	Tanneries.	Flax Mills (Ireland).	Printing Works.							Tanneries.	Flax Mills (Ireland).	Shops.	Leather.	Paper.										
DUBLIN.																								
Broadbent, R. S., *Alliance* ...	P	P	P	H	H	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...
Campbell, W. P., *Royal Exchange*	P	P	...	...	...	...	...	...	...	...	..	H	P	P	H	P	...	...	...	...	...	...	...	...
Cruise, W. A. R., *Patriotic*	...	...	...	...	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hughes, E. A., *Royal Exchange*	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mangan, C. B., *Royal Exchange*	...	...	...	P	P	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...
McConnell, W. H., *Guardian*	...	...	...	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Reid, E. T. A., *General Accident*	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sargeant, G. J., *Scottish Union and National*	...	...	...	...	...	...	...	...	...	P	H	P	P	...	P	P	...	...	...	...	...	...	...	...
Scott, C. C., *Royal Exchange*	P	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sparrow, G. F., *London and Lancashire*	...	...	...	...	...	...	...	...	...	H	H	...	P	P	...	P	...	...	...	...	...	...	...	...

Thomson, A. F., *Royal* ...	...	...	...	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Verdon, J. R., *Phœnix* ...	P	P	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...
Dundee.																								
Low, A. S., *Royal Exchange*	...	...	...	P	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...
Maitland, A., *General Accident*	...	...	...	...	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Marquis, A., *North British and Mercantile*	H	H	...	...	...	C	C	C	...	H	H	H	H	P	...	P	...	...	...	...	...	...	...	...
Miller, T. J. G. A., *Royal* ...	...	...	...	H	P	...	C	C	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...
Robertson, E., *London* ...	...	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Simpson, A. M., *State* ...	P	P	...	...	H	...	...	...	..	...	...	...	...	...	...	...	...	....	..	...	...	...	...	...
Stewart, W. M. H., *North British and Mercantile*	...	...	...	...	...	C	C	C	...	H	H	H	P	P	...	P	...	...	...	...	...	...	...	...
Edinburgh.																								
Anderson, J. M., *North British and Mercantile*	...	...	...	...	...	...	...	...	...	H	...	...	H	...	...	...	...	...	...	...	...	...	...	...
Cownie, D., *General Accident*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	H	P	...	...	...	...
Fyfe, H. M., *North British and Mercantile*	...	...	...	...	...	..	...	...	...	...	...	...	...	...	H	...	...	...	...	...	P	H	...	...
Green, G. H., *Caledonian* ...	P	...	P	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Isdale, J. D., *Scottish Union and National*	P	...	...	P	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1905—*continued.*

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Dublin.																								
Broadbent, R. S., *Alliance* ...	P	P	P	H	H	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...
Campbell, W. P., *Royal Exchange*	P	P	...	...	...	...	...	...	...	...	..	H	P	P	H	P	...	...	...	...	...	...	...	...
Cruise, W. A. R., *Patriotic*	...	...	...	...	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hughes, E. A., *Royal Exchange*	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mangan, C. B., *Royal Exchange*	...	...	...	P	P	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...
McConnell, W. H., *Guardian*	...	...	...	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Reid, E. T. A., *General Accident*	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sargeant, G. J., *Scottish Union and National*	...	...	...	...	...	...	...	...	...	P	H	P	P	...	P	P	...	...	...	...	...	...	...	...
Scott, C. C., *Royal Exchange*	P	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sparrow, G. F., *London and Lancashire*	...	...	...	...	...	...	...	...	...	H	H	...	P	P	...	P	...	...	...	...	...	...	...	...

Thomson, A. F., *Royal* ...	...	...	...	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Verdon, J. R., *Phœnix* ...	P	P	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
DUNDEE.																								
Low, A. S., *Royal Exchange*	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Maitland, A., *General Accident*	...	...	...	...	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Marquis, A., *North British and Mercantile*	H	H	...	...	...	C	C	C	...	H	H	H	H	P	...	P	...	...	...	...	...	...	...	...
Miller, T. J. G. A., *Royal* ...	...	...	...	H	P	...	C	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Robertson, E., *London* ...	...	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Simpson, A. M., *State* ...	P	P	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Stewart, W. M. H., *North British and Mercantile*	...	...	...	...	...	C	C	C	...	H	H	H	P	P	...	P	...	...	...	...	...	...	...	...
EDINBURGH.																								
Anderson, J. M., *North British and Mercantile*	...	...	...	...	...	...	...	...	...	H	...	...	H	...	...	...	...	...	...	...	...	...	...	...
Cownie, D., *General Accident*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	H	P	...	...	...	...
Fyfe, H. M., *North British and Mercantile*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	P	H	...	...
Green, G. H., *Caledonian* ...	P	...	P	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Isdale, J. D., *Scottish Union and National*	P	...	...	P	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1905—*continued.*

	Part I. Policy Drafting. Tanneries.	Part I. Policy Drafting. Flax Mills (Ireland).	Part I. Policy Drafting. Printing Works.	Part I. Re-insurances.	Part I. General Rules.	Part I. Book-keeping.	Part I. Chemistry.	Part I. Electricity.	Part I. Passed in Part I.	Part II. Tariffs. Tanneries.	Part II. Tariffs. Flax Mills (Ireland).	Part II. Tariffs. Shops.	Part II. Processes. Leather.	Part II. Processes. Paper.	Part II. Building Construction.	Part II. Correspondence.	Part II. Plan Drawing.	Part II. Passed in Part II.	Part III. Law of Fire Insurance.	Part III. Avge. Clauses and Loss Apportnmts.	Part III. Fire Extinguishment.	Part III. Electricity.	Part III. Chemistry.	Part III. Passed in Part III.
LEEDS—*continued.*																								
Sunderland, E. A., *Guardian*	P	...	P	...	P	...	C	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Vaughan, C. G., *British Law*	P	...	...	...	...	...	...	...	...	H	...	H	H	...	...	P	...	...	...	...	...	...	...	...
LIVERPOOL.																								
Colbeck, T. O., *General Accident*	...	...	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
O'Neill, H. E., *Northern* ...	P	...	...	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
LONDON.																								
Angier, H. A., *Hand-in-Hand*	H	P	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bowdon, F. E., *Hand-in-Hand*	H	...	...	H	...	...	...	...	...	H	...	H	H	...	...	H	P	...	...	...	...	...	...	...
Buttery, H. R., *Hand-in-Hand*	H	...	...	...	...	...	...	...	1905	H	P	H	H	...	H	P	P	...	...	...	...	...	...	...

Clayton, A. E., *Law Union and Crown*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	1905	P	P	...	...	...	...
Elliott, P. St. J., *Law Union and Crown*	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..
Gerrard, J. G., *Royal* ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	P	P	H	...	...
Hassell, C. B., *Guardian* ...	H	H	...	P	H	...	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Henderson, J., *Hand-in-Hand*	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kidd, A. W. G., *Guardian* ...	...	P	...	...	P	...	C	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Lintott, A. L., *Westminster*	...	P	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Minnion, E. H., *Hand-in-Hand*	H	...	...	...	...	...	...	...	...	H	H	H	H	H	H	H	P	...	...	...	...	...	...	...
Nicholson, E. D., *Alliance* ...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...
Robinson, C. A., *Hand-in-Hand*	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...
Shee, C. W., *Law Union and Crown*	...	...	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Welson, J. B., *Provident Clerks*	...	...	...	...	...	C	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
MANCHESTER.																								
Barker, J. A., *Northern* ...	...	...	...	H	...	..	...	...	...	...	...	...	...	...	...	..	...	...	...	..	...	...	...	...
Coe, H. G., *Royal*	P	...	...	..	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...
Cooper, A. E., *Royal* ...	...	...	...	...	...	...	...	...	...	H	...	...	H	...	H	...	...	...	...	...	...	...	..	...
rimshaw, W., *Co-operative*	...	...	...	...	...	...	C	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1905—*continued.*

	Part I.									Part II.									Part III.					
	Policy Drafting.									Tariffs.			Processes.											
	Tanneries.	Flax Mills (Ireland).	Printing Works.	Re-Insurances.	General Rules.	Book-keeping.	Chemistry.	Electricity.	Passed in Part I.	Tanneries.	Flax Mills (Ireland).	Shops.	Leather.	Paper.	Building Construction.	Correspondence.	Plan Drawing.	Passed in Part II.	Law of Fire Insurance.	Avge. Clauses and Loss Apportnmts.	Fire Extinguishment.	Electricity.	Chemistry.	Passed in Part III.
Manchester—*continued.*																								
Hall, C. A., *Scottish Union and National*	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mason, J. H., *Northern* ...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mills, W. H., *Commercial Union*	...	...	...	...	...	...	...	...	...	H	H	H	H	P	H	...	...	...	...	...	...	...	...	...
Smith, S. A. G., *Alliance* ...	...	...	...	...	...	C	C	...	...	...	...	...	...	...	P	...	...	...	...	...	...	...	...	...
Stansfield, A. W., *Sun* ...	...	...	...	...	...	...	...	...	...	H	P	...	P	H	H	P	P	...	...	...	...	...	...	...
Yorston, C., *British Law* ...	...	...	...	...	...	...	...	...	...	...	...	...	H	P	...	...	...	...	...	...	...	...	...	...
Newcastle.																								
Allen, D. C., *North British and Mercantile*	...	...	...	...	...	...	...	...	...	...	...	H	H	...	H	H	...	...	...	...	...	...	...	...
Armstrong, R. P., *Royal Exchange*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P	P	...	1905	...	P	...	...	...	...
Barclay, J. H., *Atlas* ...	P	P	...	...	...	...	...	...	...	H	H	H	...	...	H	...	...	...	...	...	...	...	...	...

Bibby, J. V., *Alliance* ...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bonner, T., *London and Lancashire*	...	...	...	P	...	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Brown, J. A., *North British and Mercantile*	H	H	P	H	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chapman, E. H., *London and Lancashire*	...	P	...	...	H	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...
Davison, T., *Alliance* ...	...	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gardner, R. O., *Royal* ...	...	...	...	...	...	...	...	...	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...
Gofton, J. P., *Royal* ...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...
Gofton, W., *London and Lancashire*	...	...	...	...	...	...	...	...	...	H	...	H	H	P	...	H	...	...	...	...	...	...	...	...
Hanson, G. E., *Norwich Union*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	1905	...	...	...	...	...	...
Heron, A. J., *Commercial Union*	P	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hicks, J. E., *North British and Mercantile*	...	...	...	...	...	...	...	...	...	...	...	H	H	...	H	P	...	...	...	...	...	...	...	...
Hopper, W. J., *Royal* ...	H	...	...	...	...	...	...	...	...	...	...	...	P	...	...	P	H	...	...	...	...	...	...	...
Howitt, V. H., *Law Union and Crown*	P	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hughes, A. V., *Yorkshire* ...	P	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hughes, B., *Union*	...	...	...	...	...	...	...	...	...	H	...	H	H	H	...	...	...	...	...	...	...	...	...	...
Judge, J. J., *Norwich Union*	...	...	...	...	...	...	...	...	...	P	...	...	P	...	...	P	...	...	...	...	...	...	...	...
Marrs, A. M., *Royal Exchange*	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Marshall, S., *Norwich Union*	H	...	...	...	...	...	...	...	...	H	...	H	...	...	...	...	...	...	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1905—*continued.*

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Newcastle—*continued.*																								
Monkman, P. L., *Yorkshire*	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	P	P	1905	...	...	..	...	...	...
Merson, J. L., *London and Lancashire*	...	...	...	...	...	...	...	...	...	H	...	...	P	...	H	...	...	1905	H	P	...	...	...	...
Penney, H. G., *Royal Exchange*	H	...	...	H	H	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Quin, H. E., *County*	H	H	...	H	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sopwith, S., *North British and Mercantile*	H	...	...	...	...	...	...	...	...	...	...	H	H	P	H	P	...	...	...	...	...	...	...	...
Waite, R. K., *Royal* ...	...	...	...	...	H	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...
White, C., *British Law* ...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wood, C. S., *Norwich Union*	...	...	...	...	...	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Woodward, J. S., *North British and Mercantile*	P	...	...	P	H	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...

NORWICH.																								
Goddard, S. W., *Norwich Union*	...	...	...	...	...	C	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Page, C. F., *Norwich Union*	...	...	...	...	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Stratford, B. F., *Norwich Union*	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
NOTTINGHAM.																								
Ainsworth, F., *Northern* ...	P	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mallett, R. W., *Northern* ...	P	...	...	...	...	...	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...
PERTH.																								
Brown, J. M., *General Accident*	P	P	...	...	P	...	C	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Brown, R., Jun., *General Accident*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	P	...	...
Campbell, K., *General Accident*	...	...	...	...	...	...	...	...	1905	H	P	P	P	P	...	H	...	...	...	...	...	...	...	...
Hutchison, J., *General Accident*	P	P	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
SHEFFIELD.																								
Clarke, K. R., *Alliance* ...	...	...	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fryer, L. H., *Alliance* ...	H	...	P	H	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Moorhouse, J. D., *Alliance*...	P	...	P	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
'lips, L., *Alliance* ...	H	...	...	...	...	C	...	...	1905	H	P	H	H	H	H	P	H	1905	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1905—*continued.*

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Sheffield—*continued.*																									
Phillips, W. H., *Alliance* ...	H	...	P	H	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pughe, L. E., *Alliance* ...	H	...	...	...	...	...	C	...	...	H	...	H	H	H	...	H	...	...	...	...	...	...	...	...
Unwin, E. B., *Alliance* ...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Shrewsbury.																									
Roberts, M. H., *Alliance* ...	P	P	P	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
York.																									
Wood, H. H., *Yorkshire* ...	...	...	...	...	...	...	...	...	...	...	...	...	...	P	...	H	...	...	...	...	...	...	...	...

ACCIDENT BRANCH.

	Part I.				Part II.					Part III.		
	Correspondence.	Book-keeping.	Classification.	Knowledge of Employers' Liability.	Claims.	Policy Drafting.	Indemnity Insurance.	Medical and Surgical Terms.	Passed in Part II.	Law.	Employers' Liability (Continental).	Accident Insurance Law.
Bristol.												
Owen, E. E., *Guardian*	...	...	...	H	...	...	...	...	...	...	...	...
Dundee.												
Maitland, A., *General Accident*	...	C	...	...	...	...	...	...	...	...	...	...
Edinburgh.												
Black, R., *Ocean*	...	...	...	...	H	H	P	H	1905	...	...	...
Robertson, T., *Accident*	P	C	P	...	...	...	...	...	...	...	...	...
Ross, B. M., *Life and Health*	...	...	...	H	...	...	...	...	...	...	...	...
Glasgow.												
Walker, H. F., *London and Lancashire*	H	...	...	...	...	...	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1905—*continued.*

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Leeds.												
Coltman, A., *Employers' Liability* ...	...	...	...	...	...	...	...	...	...	...	...	H
Vickers, E. A., *Ocean Accident*	...	C	...	...	...	...	...	...	...	...	..	...
Liverpool.												
Muir, A., *Guardian*	P	C	P	...	...	...	...	...	...	...	...	...
London.												
Denham, A. E. F., *Ocean*	H	...	P	...	...	...	...	...	...	...	...	...
Milton, L., *Ocean*	...	...	...	P	...	...	...	...	...	...	...	...
Spiller, T. W., *National Union*	P	C	...	...	...	...	...	...	...	...	...	...
Manchester.												
Lawton, J. T., *Compensation and Guarantee*	...	...	...	P	...	...	...	...	...	...	...	...
Robertson, A. B., *Norwich and London*	...	...	P	P	...	...	...	...	...	...	...	...

Sutherland, G., *Lancashire and Yorkshire*	P	...	...	P	..	...	...	...	...	...	...	...
Walton, W., *Law Accident*	...	...	P	P	...	...	...	...	...	...	...	...
NEWCASTLE.												
Fletcher, T., *Ocean*	...	...	...	...	H	H	P	H	1905	...	...	...
Jackson, W., *Ocean*	...	...	...	...	P	...	...	P	...	...	...	...
Stobbs, J., *London and Lancashire* ...	...	...	...	...	...	P	...	P	1905	...	...	P
NOTTINGHAM.												
Hill, C. S., *Norwich and London*	...	...	...	P	...	...	...	...	...	...	...	...
Hill, F. N., *Norwich and London* ...	...	...	...	...	...	...	...	...	...	P	...	...

LIFE BRANCH.

	PART I.	PART II.	
	Proposals, etc.	Law, Correspondence, etc.	Bonus Systems, etc.
LEEDS.			
Hall, A. S., *Scottish Widows*	...	H	P
MANCHESTER.			
Swindells, F. E., *Scottish Amicable*	P	..	...

THE INSURANCE INSTITUTE OF TORONTO.

RESULTS OF 1905 EXAMINATIONS.

First Examination. Fire and Life Branches.

N.B.—Honour standing, indicated by "H"; Pass by "P."

Name.	Company.	Arithmetic.	Euclid.	Algebra.	Composition.	Book-keeping	Geography
Addison, J. R.	Brit. America	..	..	..	..	..	P
Aitken, W. H.	Western	P	P	..	..	P	P
Allison, S. E.	Canada Life	H	H	H	H	P	H
Brisley, E. G.	Union Fire	H	H	P	P	P	H
Dannecker, O.	Manufactrs.	..	..	..	P	..	..
Dinsmore, W. H.	Brit. America	..	..	..	P	..	P
Hawkins, W E	Brit. America	P	P	..	P	..	H
Howson, E. J.	Manufactrs.	H	H	..	..	P	..
Howson, F. K.	Manufactrs.	P	P	..	..	..	..
Keachie, M. M.	Canada Life	H	H	H	..	..	P
Macrae, A. S.	N. American	..	..	..	P	..	P
Macrae, E.	Lond. & Lan.	..	..	..	P	..	P
Malcolm, E. S.	Norwich Un.	..	P	..	P	..	P
Ohlman, G.	Manufactrs.	..	..	..	..	..	P
Pegler, F. E.	Manufactrs.	P	H	..	H	..	..
Robinson, J. G.	Imperial Life	P	..	..	..	..	..
Sinclair, W. A.	Canada Life	..	..	..	..	P	..
Taylor, R.	Manufactrs.	..	..	..	..	H	..

Second Examination. Life Branch.

Name.	Company.	Use of Logs. and Int. and Discount Tables.	Practice as to Apps., Med. and other Reports.	Practice as to Loans, Surrenders, and Claims.	Plans of Ass., Policy writing, Cond. of Ass., &c.	Correspondence, Literature, & Advertising.	Elementary Principles of Life Assurance Law.
Allison, S. E.	Canada Life	H	H	..	..	..	..
Brown, W. E.	Canada Life	..	H	..	H	..	..
Edwards, O. R.	Manufactrs.	H	..	..	..	..	..
Elvins, C.	Imperial	H	H	H	H	P	P
Mackie, A. C.	Canada Life	..	H	..	P	..	..
Macklin, C. C.	Canada Life	P	H	P	H	H	P
Reynolds, V. E.	Canada Life	H	H	H	H	P	H
Robb, A. M.	Canada Life	..	H	P	..	..	..
Salmon, R.	Canada Life	..	H	H	H	P	..
Sinclair, W. A.	Canada Life	H	..	..	..	..	..
Staunton, G.	Confedn. Life	..	H	..	P	..	..
White, Frank	Canada Life	..	H	P	..	..	P
Woodcock, W. A.	Canada Life	H	H	H	P	..	..

Second Examination. Fire Branch.

NAME.	Company.	General Rules, C.F.U.A.	Average and Co-Insurance Clauses.	Plan Drawing to Scale.	Chemistry (Elementary).	Re-Insurances. Policy-drafting, &c.	Correspondence, Office Practice.	Building Construction, &c.	Electricity.
Browne, J. A. -	Western - -	..	..	H	..	H	..	..	..
Carlisle, L. - -	British America	..	..	..	P	..	..	..	H
Crosby, G. E. -	Und. Insp. Bur.	P	P	P	..	H	H	P	H
Frink, H. W. -	Western - -	H	H	P	..	H	H	P	H
Gibson, C. D. E. -	Und. Insp. Bur.	..	..	..	P	..	..	H	H
Joselin, H. A. -	Norwich Union	..	H	..	..	H	H	..	..
Keys, P. C. - -	British America	H	H	P	..	H	H	..	H
Macrae, E. - -	London & Lancs.	P	..	P	P	P	H	..	..
Martin, R. R. -	Western - -	..	..	..	..	..	..	H	H
Moore, G. L. -	Western - -	P	..	P	..	H	H	P	P
Minty, G. S. -	Western - -	P	H	P	..	H	H	..	..
Sharpe, E. - -	Western - -	P	P	P	..	H	H	H	H
Thomas, G. R. W.	British America	..	..	..	..	..	..	..	H

Third Examination. Fire Branch.

NAME.	Company.	Applic. of the C.F.U.A. Mer. & Spec. Sch. upon Actual Survey.	Fire Protection, Municipal and Private.	Sprinkler Equipment.	Advanced Chemistry.	Advanced Electricity.
Fudger, W. E. - -	British America -	H	P	P	P	H
Roberts, F. E. - -	Norwich Union -	..	..	..	H	H
Szeliski, P. von - -	British America -	H	P	H	P	..

Sections F, G, H, I, and J not written upon.

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